Welding Engineer

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MARCH, 1958

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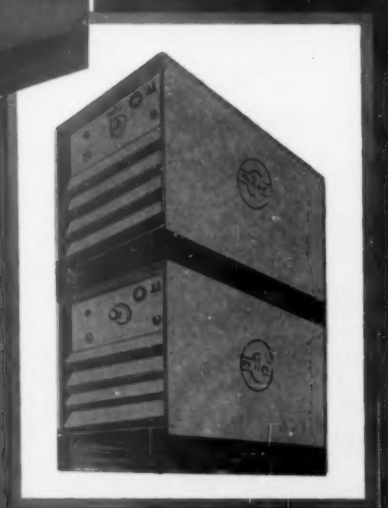

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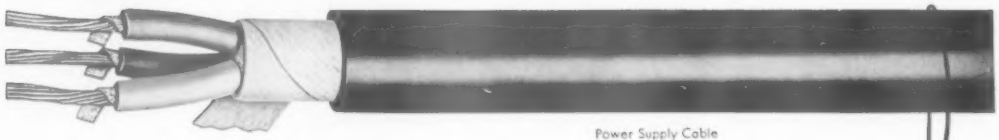

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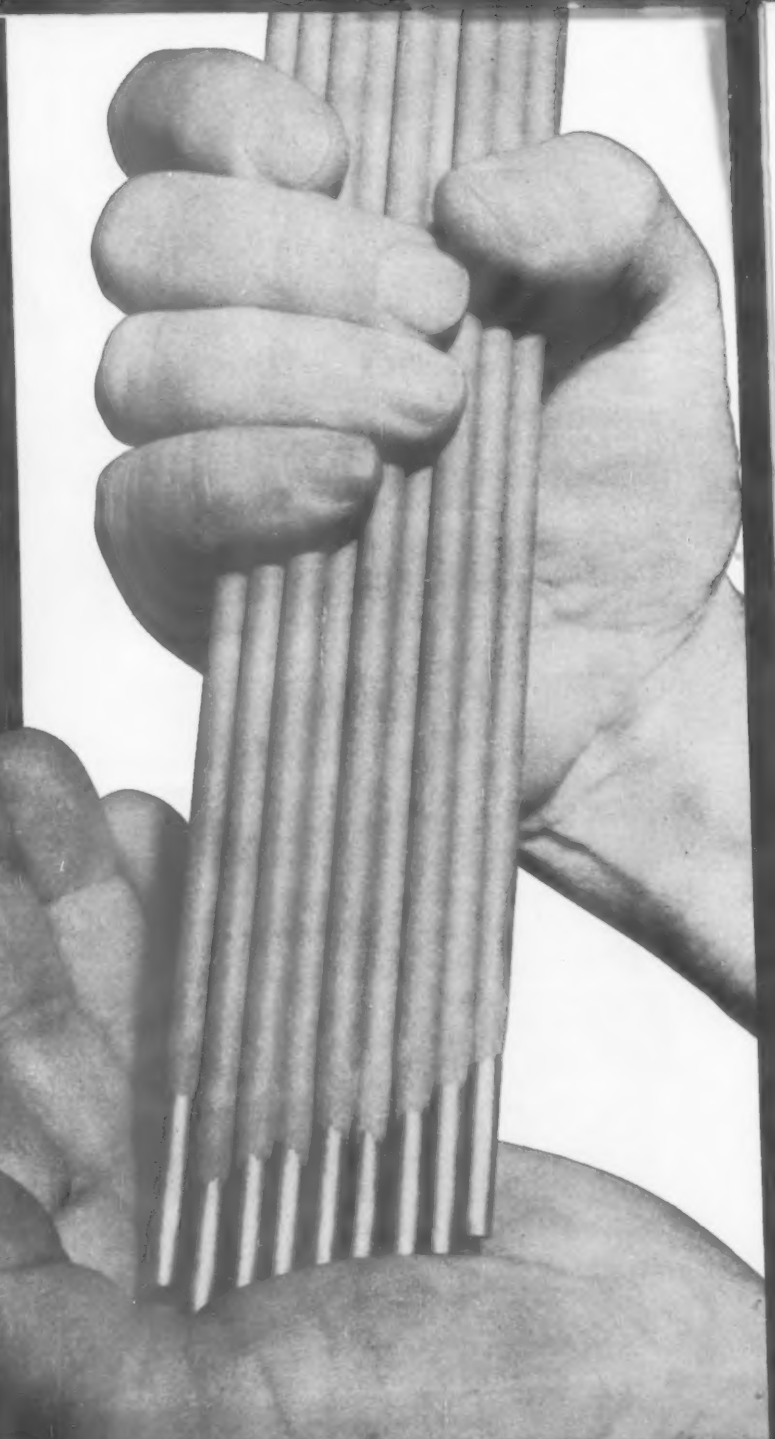

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Vol. 43 — No. 3

The magazine of joining and severing of materials

Welding Engineer

This is welding: March, 1958

Acetylene's 66-year success forecasts a popular future 29

▶ ▶ ▶ ▶ ▶ ▶ **Jack Fairlie** gives a history of acetylene from its discovery in 1836 to present-day applications of the gas in welding and cutting.

Welding aids nuclear power for civilian use 34

W. A. Heath describes fabrication of a British nuclear reactor. A staff member covers a similar event in America.

Kaiser's 3 new Mig techniques for welding aluminum 36

"Qualiweld," "Econoweld," and "Chlorecon" are the latest entries in the aluminum welding sweepstakes.

Acetylene and carbide have held jobs in almost every field 39

Sidelights on the varied—sometimes wacky—uses to which acetylene and carbide have been put in the past.

Flux in flame finds greater applications 40

E. H. Conway enumerates brazing techniques with the flux-in-flame method and what it can mean to you.

Artist cuts costs by welding 43

▶ ▶ ▶ ▶ ▶ ▶ **F. W. Foerste** visits a sculptor and learns that beauty and economy can be very closely linked.

IAA and *The Acetylene Journal* 44

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Huge ladle built in Australia 70

More than 2½ tons of submerged-arc welding wire and 3 tons of welding electrodes were consumed in fabricating this giant ladle.

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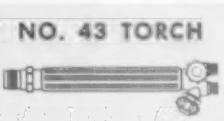

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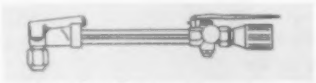

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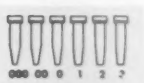
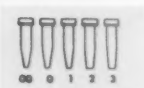
for Rivet Cutting 1-NFFR, 2-NFRR, 3-NFFR

for Rivet Washing 4-NFW, 5-NFW, 8-NFW



6290-N (normal preheat)

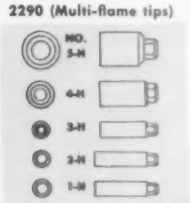
49-F (90° Head) Gas Pressure - 1 psi or more
49-N (90° Head) Gas Pressure - less than 1 psi



6290-NFF (extra fast preheat for scaly cutting)

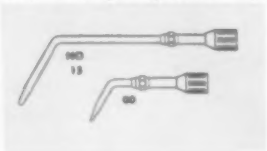
49-AF (70° Head) Gas Pressure - 1 psi or more
49-AN (70° Head) Gas Pressure - less than 1 psi

2290 (Multi-flame tips)

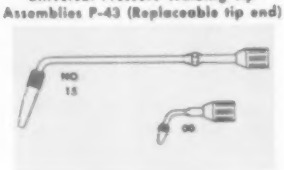


ACETYLENE WELDING TIPS ASSORTMENT

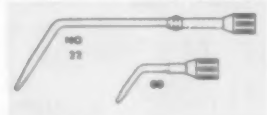
Universal Pressure Welding Tip Assemblies (L-43 Swaged "goosenock" Tips)



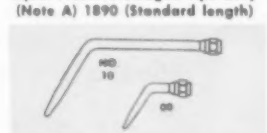
Universal Pressure Welding Tip Assemblies P-43 (Replaceable tip end)



Equal Pressure Welding Tip Assemblies (5-43 Tip sizes 00 thru 10, 12, 15, 19, 22)

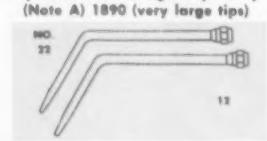


Equal Pressure Swaged Tips Only (Note A) 1890 (Standard length)



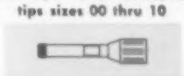
Available in sizes 00 thru 10 incl.

Equal Pressure Swaged Tips Only (Note A) 1890 (very large tips)

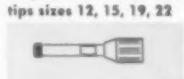


Available in sizes 12, 15, 19 and 22

Equal Pressure Mixer (Note A) D-43 for 1890 series tips sizes 00 thru 10



Equal Pressure Mixer (Note A) D2-43 for 1890 series tips sizes 12, 15, 19, 22



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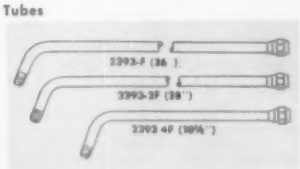
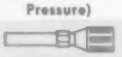
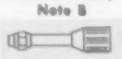


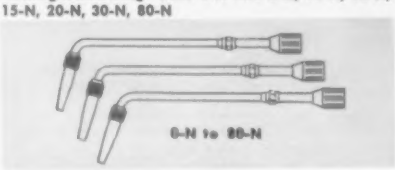
F-43 (Medium Pressure)



Mixers B-43-30-N (Low Pressure) Note B



P-43-N (Single flame tips) Universal Pressure Brazing, Heating & Soldering—Sizes 0-N thru 8-N, 10-N, 12-N, 15-N, 20-N, 30-N, 80-N



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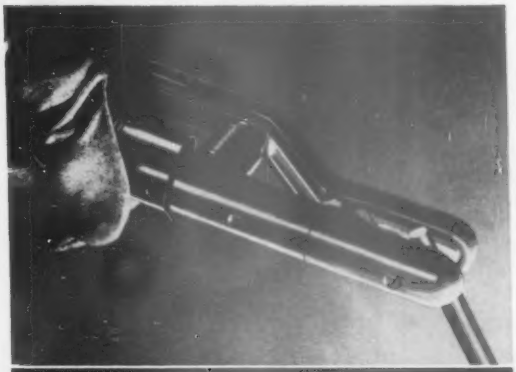


Insulated Copper Alloy Holders have greatest strength, hardness and conductivity. Jackson insulators have highest heat and impact resistance. Choose them where greater duty cycles are called for.

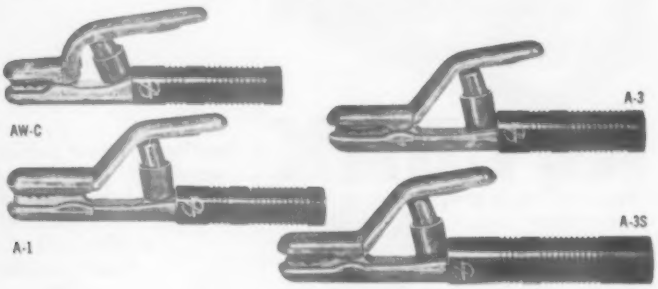
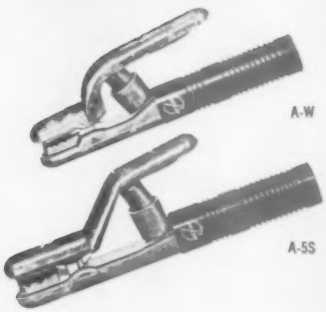


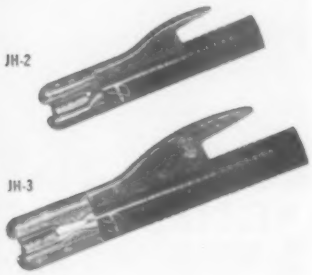
Table shows duty cycles possible with Jackson Insulated Copper Alloy Holders, using electrodes and cables shown.

Holder Class	Model	Electrode	Amps & Cable	Amps & Cable	Duty Cycle
Small	AW-C	7/32"	250—No. 1	300—1/0	30%
Medium	A-1	1/4"	300—1/0	350—2/0	50%
Large	A-3	3/8"	375—2/0	450—3/0	65%
Heavy-Duty	A3-S	3/8"	500—4/0		80%



Featherlight medium class model A-W takes electrodes through 1/4" at 300 amps, weighs 14 oz. Featherlight larger model A-5S has wider tong and wider handle, takes electrodes through 5/16" at 400 amps.

Featherlight Holders have tongs of aluminum alloy, replaceable jaws of high-copper alloy. Excellent all-purpose holders, each within its rated capacity. Cable connection must be made mechanically.



Featherlight and streamlined, small class JH-2 takes electrodes through 5/32" at 200 amps, weighs 9 1/2 oz. Medium class JH-3 takes electrodes through 1/4" at 300 amps.

'Quik-Trik' Cable Connectors 2/0-R and 4/0-R have neoprene rubber insulators with tapered ends to stretch over cable snugly. They lock out moisture and dirt, don't catch against obstructions.

Cable Splicers for permanent connections. Copper alloy with hard fiber insulators.

Cable Lugs of cast copper alloy, 180 and 45 degrees.

Jackson Ground Clamps, Cable Connectors, Splicers and Lugs are available in three sizes:

MODEL	CABLE SIZE	CABLE CONNECTION	CAPACITY
No. 1	4 thru 1/0	Mechanical, soldered, or brazed	300 amps
2/0—R* and 2/0	1/0 and 2/0	Mechanical, soldered, or brazed	500 amps
4/0—R* and 4/0	3/0 and 4/0	Soldered or brazed only	500 amps

*Cable Connectors only

Jackson Ground Clamps give broad metal-to-metal contact. They also fit the hand, go easy on, easy off. Angled socket reduces strain on cable, allows wire fastening for extra support of the cable.

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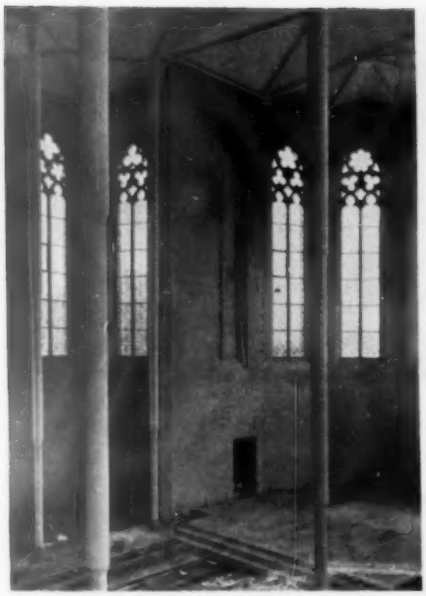
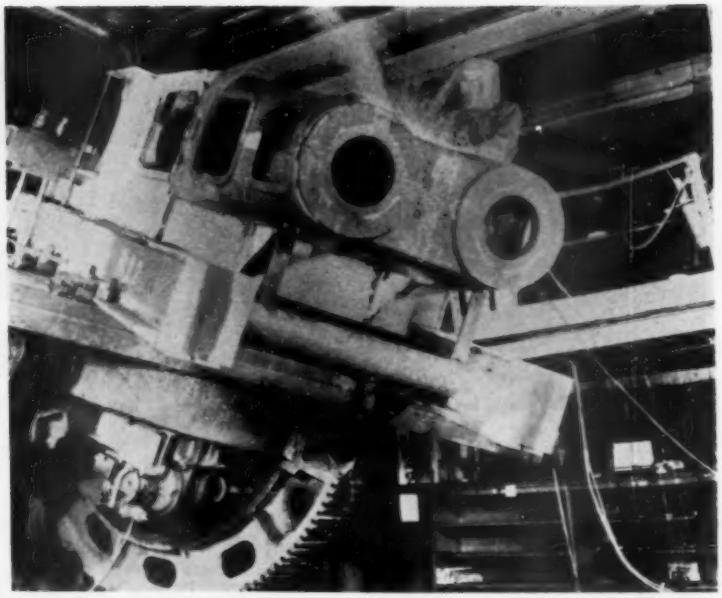


WELDED pipe columns are used in this church in Duesseldorf, W. Germany. Columns are manufacturd by Phoenix-Rheinrohr A.G.



SLUSH pump is welded in the Toledo plant of National Supply Co., Pittsburgh. Supported on a positioner, the heavy frame can be turned in any direction for welding.

News

New firm makes alloys, fluxes

American Brazing Alloys Co., Pelham, N.Y., is a new firm which is marketing a line of alloys and fluxes for brazing. Under the trade name "Ambraze", the line meets all government, ASTM and AWS specifications, the firm reports. Mike Ross heads the sales program.

8 chairmen appointed for western meeting

Eight leaders of industry have been chosen chairmen of technical sessions of the March 27 and 28 First Western Welding, Brazing and Heat Treating Conference, sponsored by the Golden Gate chapter of the American Society for Metals.

The men are: Dr. E. R. Mertz, manager of materials laboratory, Aerojet-General Corp., Sacramento; E. F. Mellinger, Ryan Aeronautical Co., San Diego; Dr. Aaron Wachter, manager of materials engineering and corrosion, Shell Development Co., Emeryville, Calif.; J. B. Dotson, chief metallurgist, Nordstrom Valve Div., Rockwell Mfg. Co., Oakland, Calif.; R. M. Heintz, Los Gatos, Calif.; J. V. Long, director of research, Solar Aircraft Co., San Diego; Dr. R. Huggins, professor of metallurgy, Stanford University, and J. S. Patterson, hull superintendent, Bethlehem Pacific Coast Shipbuilding Co., San Francisco.

The conference, to be held at Stanford Research Institute, Menlo Park, Calif., will include a round-table question and answer panel opening free discussion of technical problems.

Santa Clara AWS sponsors welding show

The Second Welding, Brazing and Heat Treating Show, sponsored by the Santa Clara Valley section of the American Welding Society, will be held in San Jose, Calif., March 27 through 29. It is timed with the First Western Welding, Brazing and Heat Treating Conference, given by the Golden Gate chapter of the American Society for Metals, March 27 and 28, at Stanford Research Institute in nearby Menlo Park (see above).

Newark firm buys Universal Welder

Electric Arc, Inc., recently acquired Universal Welding Corp., Cleveland manufacturers of resistance welding machines. Production machinery, patterns and other Universal properties are being moved to Electric Arc's Newark plant. Herman Sahli, chief engineer for Universal, will hold a similar position with Electric Arc. The purchase expands the Newark firm's product line to include spot welders, seam welders, butt welders and other resistance welding equipment.

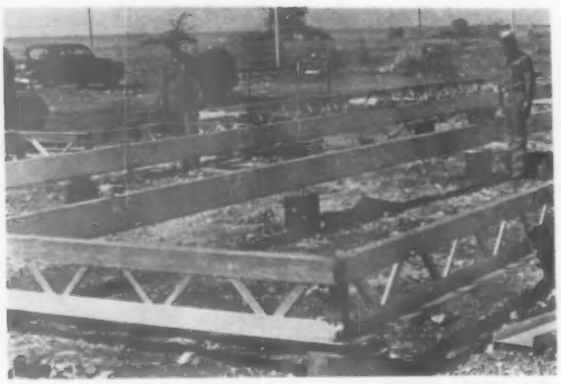
Vern Miller heads H. K. Miller firm

At the annual meeting of H. K. Miller Co.'s board of directors, Vern Miller was elected president. He had been vice president of the Chicago firm. Sales manager Ed Kellan will fill the vice presidential spot.

Cincinnati AWS holds conference

A one-day technical meeting March 20, sponsored by the Cincinnati section of the American Welding Society, will include sessions on brazing, metal-arc welding, metallurgy, resistance welding. A question-answer series and panel of experts will round out the program.

WHITE-shirted Tom Whedon demonstrates correct hard-facing techniques at Amsco's recent training course. *(See story below.)*



CONCRETE piers—42 of them—hold base members of a welded steel frame house built near Fort Worth, Texas. *(See story below.)*

Amsco salesmen get weld know-how

To give its casting salesmen a working knowledge of welding materials, American Manganese Steel Div. of American Brake Shoe Co. held a series of meetings recently at its Research Center in Mahwah, N.J. Stressing the fact that once a casting is sold and in service, the problem is one of repair and build-up rather than replacement, the course covered types of welding electrodes and rods to be used, techniques in keeping cracks from spreading, etc., specifics of welding manganese steel and the effects of alloying medium carbon steel and manganese.

Technion Design changes name

Technion Design & Mfg. Co., Inc., recently changed its name to Duramic Products, Inc. Headquarters will remain in New York City, but expansion plans are in the making for facilities outside of the area.

Wolfenden takes lion's share

When it comes to Hobart Brothers' distributor sales contest, Wolfenden Welding Supplies, Inc., Cleveland, has been taking the lion's share. For the third consecutive year the firm has finished first among Hobart Brothers' distributors. This year it turned in the largest volume of business. Second place went to Roy Smith Co., Detroit, and third to H. K. Miller, Inc., Chicago.

Virginia Welding Supply Co., Charleston, W. Va., also took a first in the contest by totaling the largest percentage over quota of any of the Troy, Ohio, firm's distributors.

Fibre-Metal adds Canadian warehouse

A warehouse in Toronto, Canada, was recently opened by Fibre-Metal Products Co. of Chester, Pa. General manager of the warehouse, Fibre-Metal (Canada) Ltd., will be Gilbert Doyle.

Gold alligators used to mark 50th year

To mark its 50th year of manufacturing electric clips, Mueller Electric Co., Cleveland, is giving away gold-plated alligator clips as souvenirs. The first model clip to be designed, "No. 27", is still a top seller, the firm boasts. In 1908, Ralph S. Mueller started the firm, which has "spanned the age from gaslights to satellites".

For the anniversary clip, write to Mueller Electric Co., 1594CC East 31st St., Cleveland 14, Ohio.

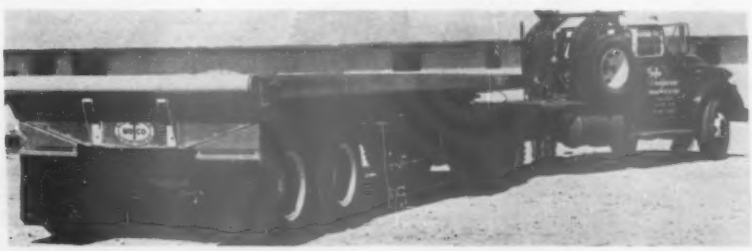
Builds welded home skyscraper style

Using a modification of the foundation system used for skyscrapers, Paul F. Watson built his new home with a welded rigid steel frame with base members set on 42 cylindrical concrete caisson or piers. The house is located near Fort Worth, Texas. Sheathed in "Sonatubes," a non-metallic lining material which prevents bonding to earth, the piers extend 9 ft to bedrock. Well below the water table, any movement of the subsoil because of freezing, etc., cannot move the foundation piers.

The frame base, with outer members fabricated from longitudinal angles and diagonal bracing angles are welded together, and the central I-beam joints, are held to the piers by lag bolts set into the concrete on the top surface, Lincoln Electric Co. reports.

Masonry walls of the house, as well as a large fireplace, are supported on a steel apron welded to the low base angle of the frame, keeping the whole structure above ground level. The recently-finished three-bedroom, two-bath brick veneer building has shown no sign of settling or wall cracking.

"Steel offers uniform strength and is very versatile. You can chop it and change it at any time by welding. You can't do that very easily with concrete," says Watson, secretary treasurer of the Watson Foundation Co., Fort Worth, Texas.

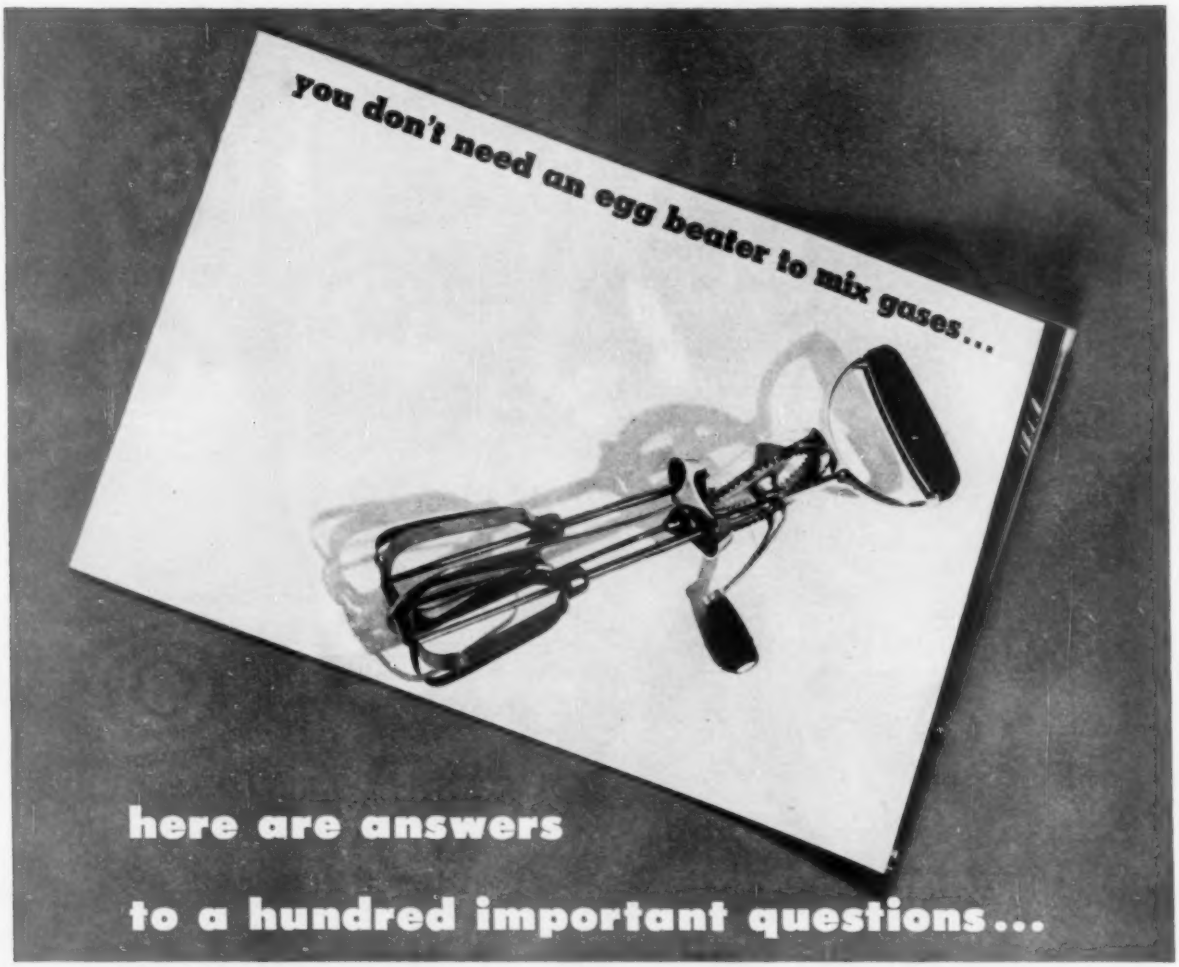


WELDED aluminum flatbed trailers are making impressive payload records hauling heavy oil equipment in Wyoming and Montana. (See story at right).

Welded trailers increase payloads

Welded aluminum flatbed trailers are increasing payloads by 4,000 to 4,500 lb for truckers hauling heavy oil field equipment over the rugged mountain country in Wyoming and

(Continued on page 84)



Would you like answers to questions such as these?

- what is gas and how does it behave
- how do gases mix in a torch
- what are the more important flame temperatures
- which is hotter — the oxydizing or carbonizing flame
- why do some flames heat rapidly and others slowly
- can you guess the speed of a gas molecule

Would you like to see full color pictures of seven different flame types?

National of ...california

The answers to these questions are but a sample of the interesting information this booklet brings to you.

Do write now for your *FREE* copy.

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Please send FREE booklet "you don't need an egg beater to mix gases"

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NATIONAL welding equipment company... 218 fremont street san francisco 5 california

If you buy a welding machine without all these features..... **You're**

Does it have jet-stream ventilation?

The ultimate advantage of this feature is that the machine will run cooler, need less maintenance, last longer. High-velocity air has a scouring effect, keeps dirt from collecting on coils and stacks. Remember, dirt not only impairs efficiency but also retains heat.

asking for trouble!

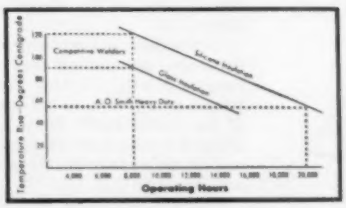
Only machines offering *all* these advantages can truly provide lasting, highly satisfactory, trouble-free service. Only A. O. Smith machines can answer the challenge!

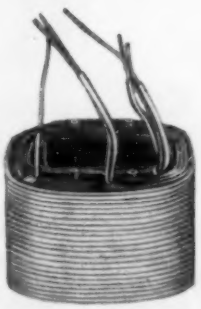
Only A. O. Smith offers you the welding machines of tomorrow — today. Every machine in the line offers the features illustrated. And these and other A. O. Smith features add up to longer life, fewer production stoppages due to breakdowns, less cost for maintenance and service.

Further, A. O. Smith offers a complete line — in most cases several choices in each size. That means you can choose a machine tailored exactly to your present and future needs.

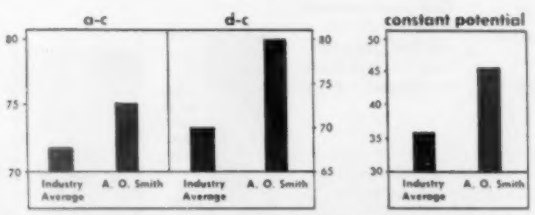
Look these features over carefully. Then see if the next welding machine salesman that calls can match them. He can't! Only the man from A. O. Smith can! Check him before you buy!

Does it have silicone insulation? All A. O. Smith machines do. Silicone (Class H insulation) is the newest, most expensive insulation known to the electrical industry. Despite higher costs, A. O. Smith is the *only* machine manufacturer using silicone "right-across-the-board" on *all* models. Silicone permits higher operating temperatures under peak load conditions and absolutely prevents coil damage due to moisture accumulation. Longer life is assured.

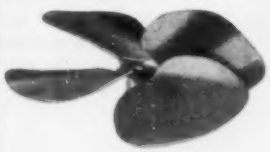




Does it offer doubly protected coils? On A. O. Smith units, coils are not only vacuum-impregnated, they're also precision wound. Result: They're resistant to moisture and there's no possibility of chafing each time an arc is struck. This double protection results in stepped-up efficiency—for years on end.



Does it have bonus open-circuit volts? The charts above provide an idea of why all A. O. Smith machines "go beyond the call of duty"... provide bonus open-circuit volts for more force, more drive and greater arc stability. It's this bonus margin that makes A. O. Smith welders and rectifiers the machines of the future.



Does it offer a totally enclosed pre-lubricated, ball bearing, 1/6-hp fan motor and big fan? Only A. O. Smith welding machines are built with a big husky, forget-about-it motor that needs no reservoir filling or other costly production-stopping maintenance. Biggest fan in the industry, sustains tremendous volume of high-velocity air to keep machine running cool.

If you'd like to know more about the extra things A. O. Smith does to help your welding machine investment pay bigger returns . . . details about the complete A. O. Smith line of a-c, d-c and constant potential machines . . . contact your "man from A. O. Smith" or write direct.

Through research . . . *a better way*

A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
A. O. Smith International S. A., Milwaukee 1, Wisconsin, U. S. A.

BRAZED SUCCESSFULLY

WITH

SILVALOY

LOW TEMPERATURE SILVER BRAZING ALLOY

Brazed assemblies come swiftly off the business end of a sound, efficient production line developed at Maytag. In this operation a bottom plate is brazed to the center shaft and sleeve used in the Maytag No-Vent Clothes Dryer.

The technic is simplicity itself—yet it makes for peak production and excellent brazing results. Briefly, Silvaloy Preformed rings are stored on a sleeve of a diameter equal to that of the center shaft. Rings are easily, rapidly slipped from sleeve to shaft—bottom plate is positioned—assembly is placed in a fixture and brazed.

Maytag Washing Machines and Clothes Dryers are built for long, dependable service. High production standards are therefore a "must" at Maytag. Brazing operations are kept to that standard with the aid of Silvaloy Low Temperature Brazing Alloys and APW Fluxes.

Silvaloy Brazing Alloys and APW Fluxes are helping to speed production, lower costs and improve brazing results in many fields. Call your nearest Silvaloy Distributor for information or technical assistance. ★ ★

Maytag

The Maytag trademark is a recognized sign of quality in every consumer market where household laundry equipment is sold. ★ ★ ★ ★ ★

FREE: These two complete reference manuals for low temperature silver brazing and fluxing are available upon request. Send for either one or both.

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APW LOW TEMPERATURE SILVER BRAZING ALLOYS AND FLUXES

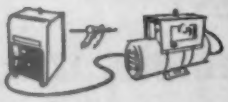
MARCH
1958

Your

Weld World

at press time

Last minute news of interest to those engaged in joining and severing materials.



. . New "LC" welding system will be introduced by Bernard Welding Equipment Co., Chicago, at next month's welding show. Process is said to deposit conventional stick electrodes at speeds higher than those obtained with semi-automatic methods. Firm claims costs can be cut 25% to 50% by new system, which will be priced lower than $400.

. . A. O. Smith was to have introduced new concept in multiple welding last week (Feb. 26-27) in New York. It's integrated multi-arc distribution system from one power source. More details next month.

. . Air Reduction Co.'s president, John A. Hill, in recent interview, said he doubts electrode prices will be raised further this year. Nevertheless, he said the 3% hike made Jan. 1 was not enough to offset increased costs.

. . Watch for a new type of backing ring soon to be marketed. Made of graphite, ring is for pipe and also comes in strip for pressure vessels. Tests have shown no carbon pick-up in weld zone. Ring/strip is reduced to small pieces by sharp tap on pipe or vessel, can thus be removed easily by blowing or washing.

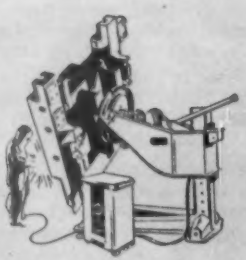
. . Look for new concept in cutting angles in structural shapes and tubing to be introduced shortly to welding industry.

. . Stressed-skin welded aluminum will be latest in bridge designs. Extensive use of welding will make aluminum competitive, costwise, with steel.

. . Another welded aluminum bridge will soon be constructed near Des Moines, Iowa. First aluminum girder span in world, bridge is developmental project sponsored by Iowa highway commission, Kaiser, Alcoa and Reynolds. Pullman-Standard Car Mfg. Co., Chicago, will be fabricator.

. . Penn-Texas Corp. has sold The Crescent Co., (Carol Cable is a division) to former owner, M. S. Sapinsley, firm's founder. Sale price: $1,100,000.

. . Three new processes for welding aluminum have been developed by Kaiser. All are Mig processes. Full details are contained in an article in this issue.



. . Harris Calorific reports it has established an Australian firm to be known as Harris Calorific Ltd. Headquarters will be in Melbourne.

. . National Ornamental Iron Manufacturers' Association has been formed by members of that industry following their second convention in Memphis. Organization hopes to see local chapters founded this year.

whether you need 10 lbs. or 10,000 lbs. you get immediate, free, "EUTECTIC" demonstration—consultation service

AGAIN FOR THE THIRD STRAIGHT YEAR "EUTECTIC" TECHNICAL REPRESENTATIVES WIN HIGHEST AWARDS FOR THE WELDING INDUSTRY

These Distinguished Salesman's Awards are presented by the National Sales Executives Club only to those men who have shown "outstanding ability to render valuable **service** to industry." The winners for the welding industry . . ."Eutectic" Technical Representatives Darrel Lent of U.S.A. and Claude Joyal of Canada . . . are but two of 350 "Eutectic" Technical Representatives who bring their know how and experience into shops and plants throughout the United States and Canada!

Factory trained by "Eutectic", whose pioneering in Low Temperature Welding Alloys and Techniques have made metal joining history, these Technical Representatives used their specialized knowledge to help solve production, maintenance and salvage welding problems in over 100,000 shops and plants in 1957!

Darrel Lent

Claude Joyal

Darrel Lent and Claude Joyal exemplify the professional stature of all "Eutectic" Technical Representatives. Their willingness to render **service** . . . to help the weldor and welding user with practical, money, labor and time saving suggestions . . . have given "Eutectic" Technical Representatives top honors in the Distinguished Salesman's Awards for the welding industry.

If you use welding . . . the most valuable asset in your shop can be the obligation-free **service** brought to you by your "Eutectic" Technical Representative . . . a service available to every user of "Eutectic" products. Call him today!

Eutectic Welding Alloys Corporation is the inventor, patentee, and only manufacturer of Eutectic "Low Temperature Welding Alloys",® which minimize or completely eliminate the troublesome warping, distortion, stress and embrittlement caused by conventional high heat welding materials.

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EUTECTIC WELDING ALLOYS CORPORATION
40-40 172nd Street • Flushing 58, New York

30 YEARS AGO

(Taken from *The Welding Engineer* of March, 1928)

Lincoln Electric Co., Cleveland, announced the appointment of O. D. Fries as salesman in charge of consumer motor business in the Detroit territory, under the direction of J. M. Robinson, district manager.

—30 YEARS AGO—

L. W. O'Day is manager of a new organization called Arc Welder Sales, dealing in new and used arc welding equipment.

—30 YEARS AGO—

The Purox Co., Denver, announces the opening of a district sales office in Chicago. M. H. Turner will be in charge.

—30 YEARS AGO—

A course in welding is included in summer courses in the College of Industries, Carnegie Institute of Technology, Pittsburgh.

—30 YEARS AGO—

R. P. Dieckelman has been made vice-president of the Pressed Steel Tank Co., Milwaukee.

—30 YEARS AGO—

W. E. Van Dreser is Wisconsin sales representative for the C. H. Hollup Corp., Chicago. He headquarters in Milwaukee.

—30 YEARS AGO—

Interest is growing in the Western Metal Congress and Western States Metal & Machinery Exposition to be held next January in Los Angeles.

—30 YEARS AGO—

Boyle Mfg. Co., Los Angeles, favors employing women weldors; they are more stable. In some cases the women make as high as $1.25 per hour, which compares more than favorably with the $21 per week offered by other trades.

—30 YEARS AGO—

Secretary of Commerce Herbert Hoover appointed Prof. Elihu Thomson, director of General Electric's Thomson research laboratory, to the American committee of the World Congress of Engineers to be held in Tokio. Other members include: Thomas A. Edison, John Hays Hammond, Charles M. Schwab and Orville Wright.

Which do you have?

"Shortstub"
ELECTRODE HOLDERS

convert the **total** fluxed portion of electrodes into **weld metal.** **Reduce stub waste to the lowest possible. . .** which means **DEPOSITED WELD METAL COSTS YOU LESS,** 15 to 20 percent less, when deposited with SHORTSTUBS!

A Saving of $15.00 to $20.00 of every $100.00 spent for electrodes!

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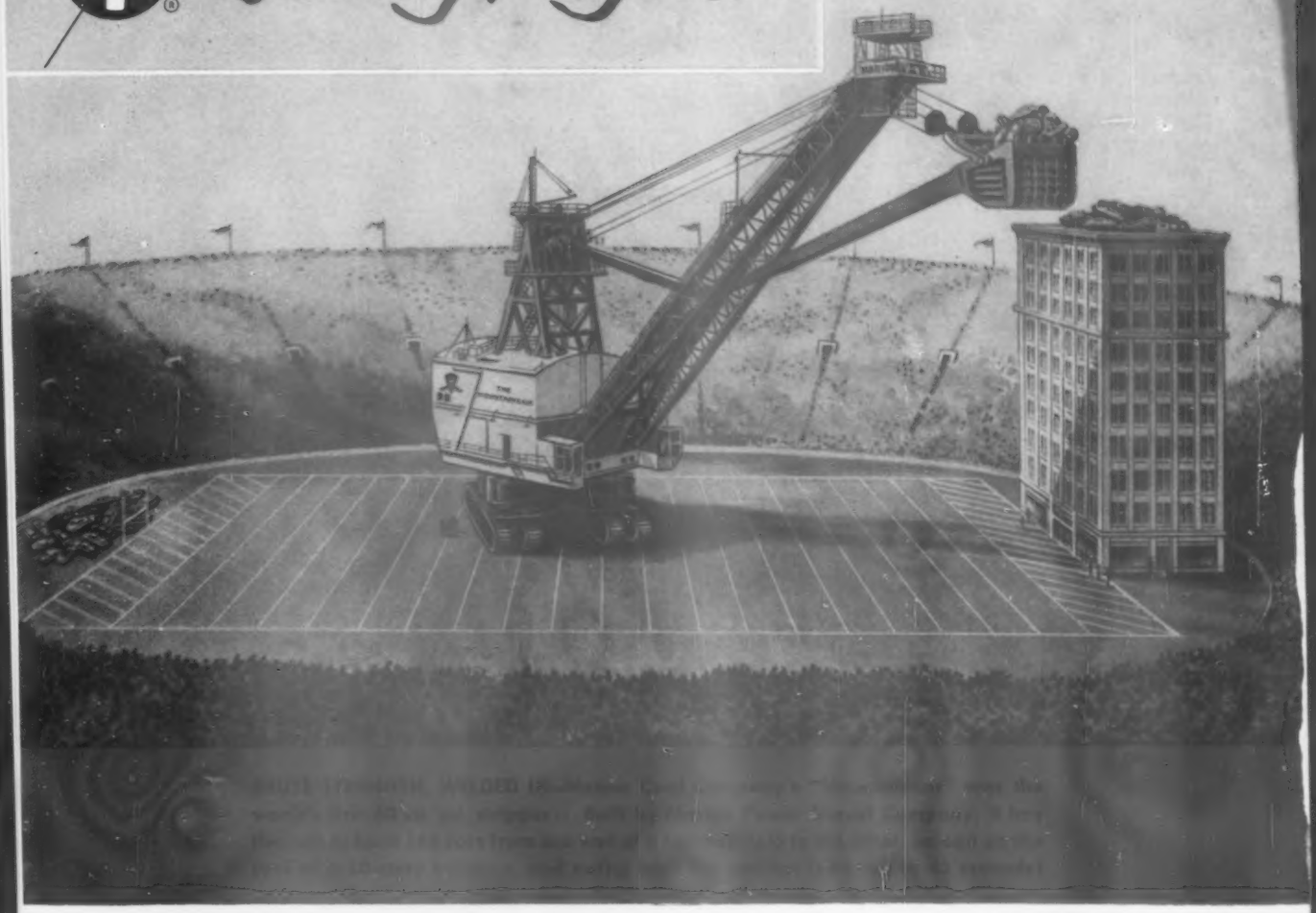


Murex® Electrodes Help Build Muscles Like This!

Much of the brawn of this 5,500,000 lb. mining giant that continuously scoops 90 tons of mountain without tiring, was knitted with Metal & Thermit arc welding electrodes.

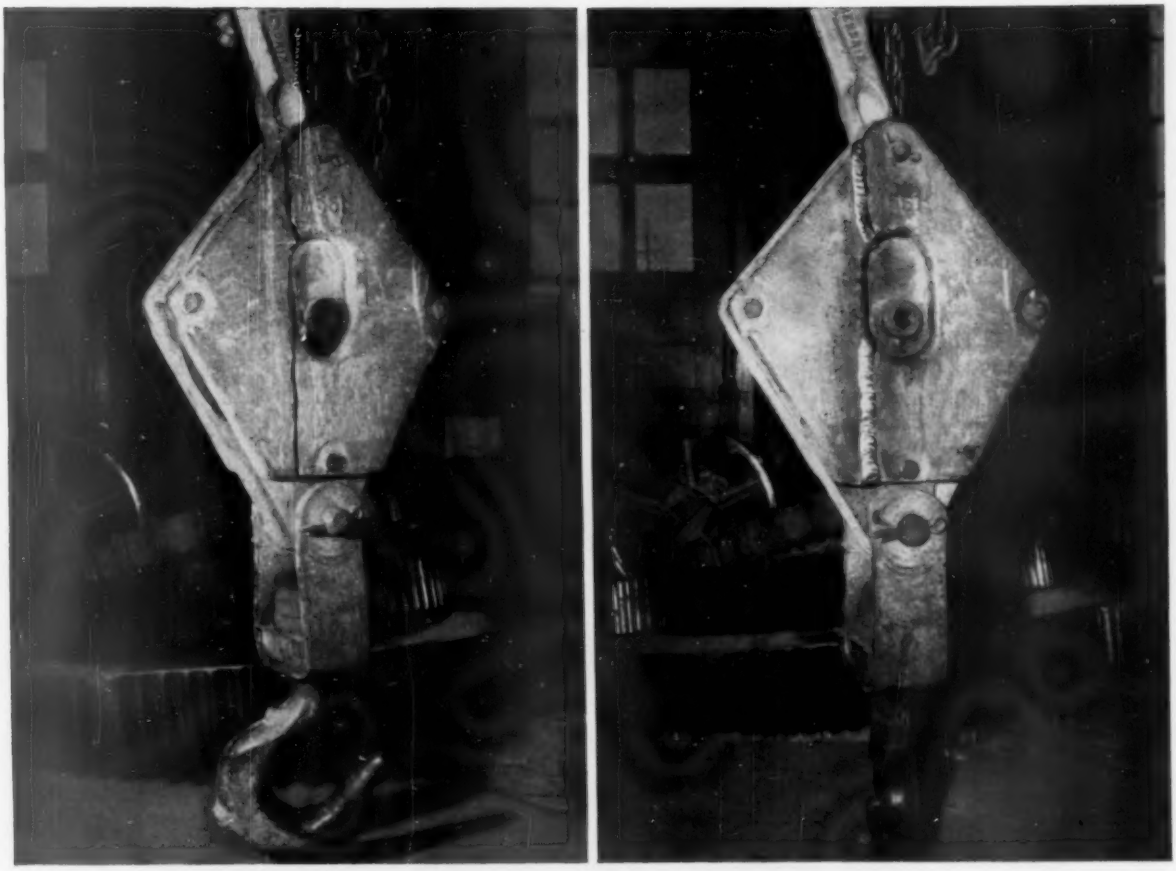
Speedex HTS, and Types HTS-18 and DM electrodes were used for *all* manual welds of the main frame structures, boom and gantry . . . Hardex 45 was used to hard surface the boom socket ears to resist impact and wear from the boom. The Mountaineer's round-the-clock performance since January, 1956, has led to the construction of four similar machines, all identically "muscle-powered" with M&T electrodes.

Selecting the right electrode for any of its line of excavators is no problem for Marion. Metal & Thermit's complete line for all welding applications can be applied to any of Marion's machines for sound, reliable, low-cost welds.

Whether you join thin sheet or heavy sections . . . fabricate or repair structures of special, mild or low alloy steels or other metals, there is a large selection from M & T's MUREX line of mild steel, iron powder and hard-surfacing electrodes to meet your requirements. Write for your copy of our helpful Electrode Selector . . . an easy reference for selection of the correct electrode for any application.

METAL & THERMIT CORPORATION

GENERAL OFFICES: RAHWAY, NEW JERSEY



Cracked cast iron block ...repaired the same day ...with Ni-Rod "55" Electrode

Replacement...or repair? That was the dilemma facing one Ohio contractor when the 150-pound pulley block shown above cracked in the middle of a job.

Replacement was expensive. And it might take days – perhaps weeks.

The contractor had heard of successful welds in cast iron with Ni-Rod* "55"* electrode and decided to go ahead with the repair.

Using Ni-Rod "55" electrode, weldors at the Alsco Welding Company in Columbus got a strong sound weld . . . had the block in operation the same day. As an extra precaution, they preheated to an estimated 250 degrees. (With Ni-Rod "55" electrode this is generally unnecessary.) The weld was approximately 14 inches long, and took only 1-1/2 pounds of 5/32-inch Ni-Rod "55" electrode.

You'll like the simplicity Ni-Rod "55" electrode brings to cast iron welding. Ni-Rod "55" electrode is operable in all positions . . . gives a stable arc and metal deposition is good. Slag is easy to remove and the welds are readily machinable.

"A Handy Guide to Welding Cast Irons" gives useful technical data, case histories and tips on welding methods. If you fabricate, repair or salvage cast iron parts, keep a copy handy. Why not write for one today?

*Registered trademark

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK **Welding Products**

Electrodes • Wires • Fluxes

Ask your welding supply dealer to show you the complete Atlas line. Atlas "Tomahawks" and "Dual Tools" are constructed to outlast ordinary weld cleaning tools and actually cost less in the long run. Welders like their "feel" and balance, turn out more and better work with less fatigue.

ATLAS WELDING ACCESSORIES CO.
707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Filler metals

New Orleans, La.

Sir:

I enjoyed the January article on "Filler metals for joining." You mentioned the 90 Cu — 10 Ni series, and that the new E Cu Ni filler type is being used in the semi-automatic inert-gas process.

I would appreciate your answers or comments to the following questions: 1) Is there a 90 Cu 10 Ni rod or wire available? 2) In the inert arc process, would you recommend the use of d-c machines or high frequency a-c? 3) What procedure as to heat treatments, preheat, etc., would you recommend?

W. G. Blackwell
New Orleans Section,
American Welding Society

—Mr. Orville T. Barnett, author of the article, tells us 1) he does not know of a 90 Cu, 10 Ni filler rod available now, but suggests you write L. H. Hawthorne of Revere Copper and Brass, Inc., Research Dept., Rome, N.Y. or J. Imperati, American Brass Co., Waterbury 20, Conn. 2) In the inert arc process first choice would be d-c welding although high frequency a-c may be used. 3) Preheat is usually not required. Keep arc length short and use as high welding speeds as possible.

Stud welding

Lorain, Ohio

Sir:

It is always most pleasant to come across an article on stud welding. (Nov., p. 72). It is particularly pleasant when the work has been done by someone outside the immediate family.

Mr. Brown has done an excellent job in handling the problem of locating studs accurately, and there is no question that his article will be of real value to those using stud welding. Many thanks for a job very nicely done.

R. C. Singleton
Nelson Stud Welding Div.
Gregory Industries, Inc.

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Manhattan Moldiscs are available in a wide range of types from harder, stiff bonds for fast roughing . . . to resilient, flexible bonds for fine finishing. Ask a Manhattan abrasive wheel engineer to show you how Manhattan Moldiscs and other Manhattan high speed, heavy duty abrasive wheels do a *better* cutting or grinding job and last *longer* . . . give you "More Use per Dollar".

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Brings good comment

El Dorado, Ark.

Sir:

We wish to add our compliments to you and your staff for the excellent job you are doing with your publications. We have heard a great deal of good comment in the trade.

Bob Morrison
United Specialties, Inc.

What more?

Hayward, Calif.

Sir:

I enjoy WELDING ENGINEER—others before me have written to you and have left me nothing to say. Keep WELDING ENGINEER as it is and it will cover all our needs.

A. E. Marcantelli

Fine magazine

Salina, Kan.

Sir:

I have been a subscriber to your magazine for the past several years. I enjoy it very much and wish to congratulate you on a very fine magazine.

Dale W. McCormick

Tungsten electrodes

Carlstadt, N.J.

Sir:

We note with interest the answer given the No. 2 question in the January *Welding Clinic*, relative to tungsten electrode longevity. The Airco recommendations are very practical and sound; however, we thought your readers may be interested in other methods to prolong tungsten electrode longevity. With Tec torches we recommend the by-passing of the water cut off solenoid, permitting a continuous flow of water through the torch head. With the cooling advantages of the Tec torch, tungsten electrodes are cooled more rapidly with the resultant tungsten saving as high as 8%.

We should also like to point out that the transparent qualities of our "Visuweld" nozzle permit the weldor to see what he welds. This important feature prevents inadvertent tungsten contamination caused by contact with the puddle.

We also recommend in our instruction sheet that the proper protrusion of the tungsten electrode on a-c welding is approximately 1/8 in. beyond the nozzle end. For d-c welding the electrode should protrude approximately 1/4 in. beyond the nozzle end.

August F. X. Michelini
Tec Torch Co., Inc.

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Complete particulars on the new Miller GOLD STAR SRH will be sent promptly on request.

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BETWEEN PASSES

acetylene issue

To commemorate the International Acetylene Association's 60th birthday, WELDING ENGINEER has devoted a large portion of this March issue to acetylene and the IAA. The anniversary month is really July, but since IAA's annual convention is being held this month in Philadelphia, we decided not to wait. We feel a close kinship to the association because *The Acetylene Journal*, which was merged with *WE* in 1931, was the official IAA publication for more than 30 years.

what's my line?

Bennett Cerf, probably more renown as a panelist on that TV show (although he is also a publisher and columnist), will be guest speaker at the banquet to be held on opening day of the American Welding Society meeting in St. Louis—April 14.

Russian lesson

Seems ironic, but maybe the communists can teach capitalist America something about the profit motive. With news pouring westward from Russia, many of us, according to the U. S. chamber of commerce, have been surprised to learn that Soviet teachers, scientists, intellectuals, industrialists—the talented, creative people—receive rich economic rewards. Hardheaded as they may be, Russian communists have never been so deceived by Marxist doctrine as to let it dictate their economic system. They understand what makes Sammy run. They move in the direction of offering more reward for greater merit. Looks like we're heading in the opposite direction. Guess labels don't mean too much nowadays.

coming up . . .

In the April issue of WELDING ENGINEER, you will read about the latest in all-welded yachts (aluminum, no less). Another ship welding story on the docket is one that concerns construction of a wine tanker. The editorial lineup for next month's welding show issue will also include many more articles of current interest . . . *articles that give you full welding details.*

tapering off

The recession continues. Business is bad, but could be worse. The last quarter of 1957 proved to be a bit off from the comparable period of the year before. The National Welding Supply Association's report on business conditions shows total 1957 sales were 5% better than in 1956, despite the 1% decrease of last year's fourth quarter.

new steel index

Too many persons outside the steel industry have misconstrued the steel capacity index put out by the American Iron and Steel Institute. For this reason, the AISI earlier this year began to emphasize actual production of steel on a weekly basis. The new procedure reports both the tonnage produced and the index of production based on the 1947-49 period. A single percentage (of capacity) figure is also being released, but the AISI feels this figure should not be used as a reliable measure of economic activity. The Institute said, ". . . the extent that the production of steel affects our economy, is better represented by actual production of steel for a given period than by the percentage which steelmaking facilities are utilized. . . The fallacy of the . . . percentage operating rate as an economic indicator has been intensified in recent years by the very substantial expansion in steel making capacity which has taken place."

ultrasonics

Ultrasonic welding is coming into its own. Newest of the machines that use high-frequency sound as an energizing source is a seam welder built by Gulton Industries, Metuchen, N. J. It is capable of joining sheet from 0.080 in. thick down to thin foil sizes. The automated welder can join this sheet or foil to almost any thickness of aluminum at speeds up to 200 ipm. Gulton plans to build similar ultrasonic machines to cost $15,000 and up. Welders will be able to join dissimilar metals, as long as one of them is thin sheet.

at last!

That was the general tenor of remarks made after the Army's Jupiter C missile put the Explorer into orbit. The United States' first satellite owes a lot to welding (as do the Russian Sputniks), for the Jupiter C is basically the Army's Redstone missile, many portions of which are welded.

RECENT visitor to our offices was Paul Leonard of Lenco, Inc., who is pictured here at mike of his radio transmitter. Leonard is amateur radio operator.

NEW G-E RESISTANCE-WELDING CONTROLS come in two lines to meet *any* non-synchronous application. *Standardline* combinations—using standard NEMA sequence timers—are specifically for normal welding applications. *Customline* combinations use unit timers to provide any control sequence needed on special-purpose, multi-electrode, or automated machines.

4 **DELAYED FIRING** allows G-E control to be used in many jobs where synchronous control is normally required.

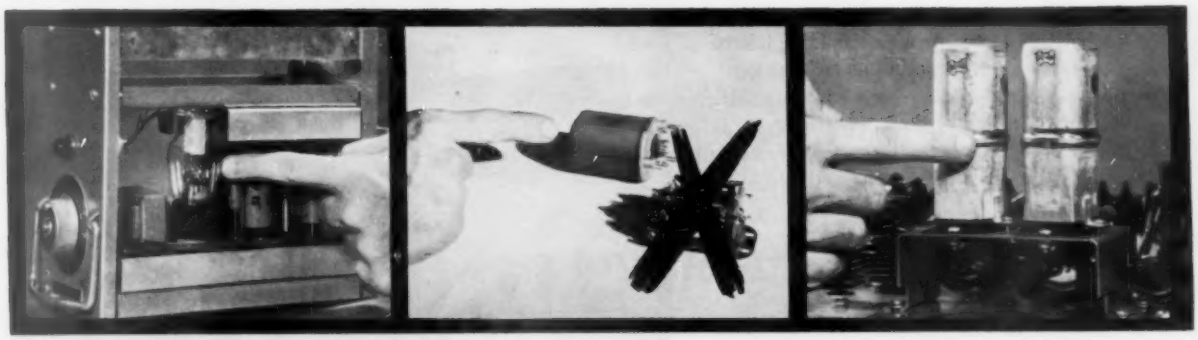
5 **EXPANDED CALIBRATION**—assures accurate setting of short time cycles for more consistent welding results.

6 **RUGGED DESIGN** gives optimum resistance to adverse conditions such as dirt, dust, moisture, and vibration.

Specify General Electric's NEW *cost-cutting* non-synchronous controls for your next resistance-welding application. For more information, write to Section 794–4, General Electric Co., Schenectady, N. Y., for bulletins GEA-6408 (Standardline) and GEA-6593 (Customline). *Specialty Control Dept., Waynesboro, Virginia.*

7 REASONS WHY GENERAL ELECTRIC'S NEW NON-SYNCHRONOUS CONTROLS PROVIDE

High-quality welds ...time after time!



1 **WELD-SAFE OPERATION** protects weld fixtures; weld-timer failure will shift control to the next timer in sequence.

2 **HERMETICALLY SEALED RELAYS**—A G-E exclusive—give functional accuracy, long life, consistent welds.

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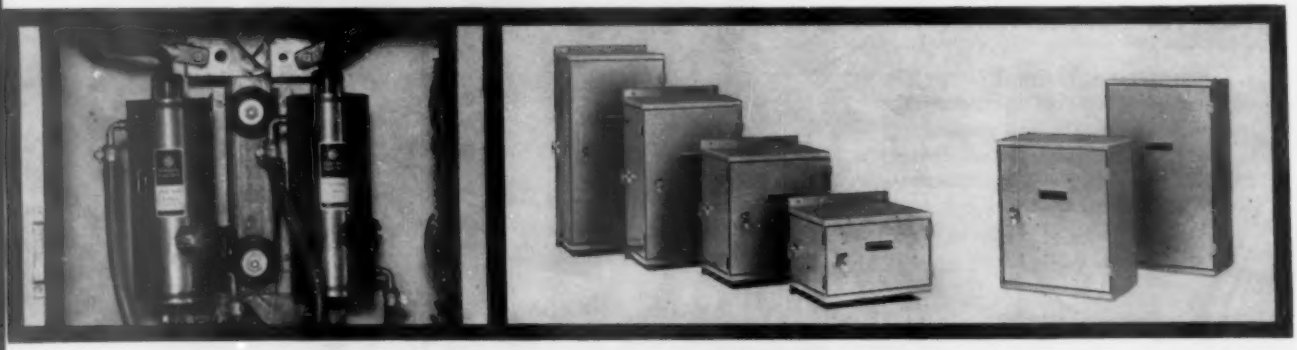

7 **FAST, ACCURATE IGNITRON CONTACTORS** provide dependable switching—free from mechanical failure.

FULL-LINE SELECTION—choice of 4 control cases and 2 contactor cases—means you can buy for present and future needs. "Building-block" design gives maximum flexibility for assembly of combinations, a simple way to add control.

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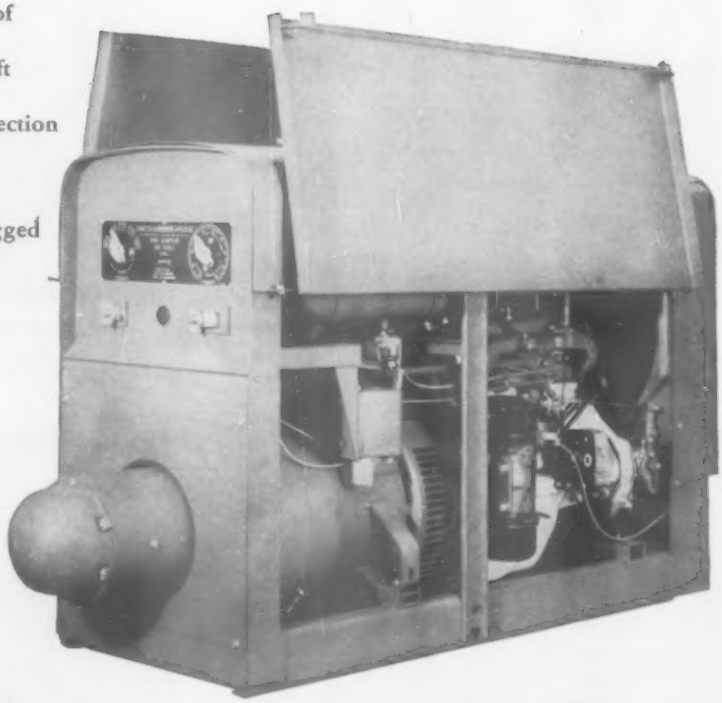

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MARCH, 1958

Welding Engineer

ESTABLISHED 1916

FEW and the future

ONCE UPON A TIME, in the days of our youth, we lived for a future that was vividly depicted in the tales of Tom Swift, or of the Hardy boys. That golden day is now upon us—though it seems less golden now than when we were younger.

But it is here, nevertheless, and now we long for that golden day—about 20 years hence—when, science tells us, man will be able to control the weather.

It is only natural to dream of the future, and the marvelously accurate crystal-gazing already done by scientists makes that future seem worth the "effort" of daydreaming.

It is a pity, however, that science is as yet unable to predict the day when welding will come into its own . . . that really golden day on which welding design walks hand-in-hand with welding application.

We wish it were otherwise. We wish, for instance, that we could know with certainty that architects, designers, plant managers, engineering professors and others would universally adopt a healthy, open-minded approach to welding next year—or, at least, 10 years from now.

The motive behind this desire for a glowing future for our industry is that we *believe* in welding. We have preached for it, written for it, striven for it.

BUT we cannot work alone.

Our urging to "Remember September—National Welded Products Month" was such that we felt sure it would capture the imagination of many who had never before spoken-up on behalf of welding.

But from interest shown to date, September, 1958, will not be much to remember.

We realize everything takes time. However, if the welding industry as a whole doesn't get into high gear in the not-too-distant future, we are all going to have lots of time to promote trips to the unemployment office rather than have national months to celebrate welded products.

Let us back up our industry with action.

We can no longer afford to have an engineer say, "Welded railway bridges? Nope, we can't use 'em! Sure, they're stronger, lighter, and less costly . . . in theory. But we can't risk finding out if they're practical."

We must educate this engineer and we must educate the engineering school professor who boasts of his shop courses in welding, but who teaches absolutely no welding design classes.

The word "educate" comes to us from the Latin for "to lead out." And this we must do. Lead these doubters and disclaimers out of their ignorance.

The welding industry must pitch in with organizations like the Welding Foundation if it wishes to promote welding.

IT MAY BE remembered that, several years ago, this page suggested a FOUNDATION for EDUCATION in WELDING. We are proud to say that this organization has been established and is on its way.

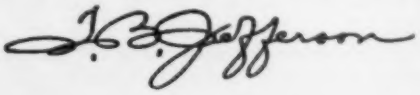
What is FEW doing to promote welding? It is planting seeds of welding where they will most flourish in the future—in the rich soil of young minds.

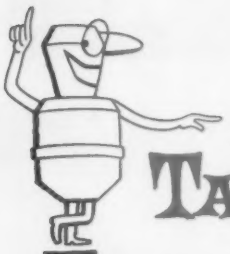
Throughout the country high school students and college students are receiving FEW's brochure, "Modern Welding Practices."

Many of these young men and women will become leading engineers. When they do, welding will be important to them. Why? Because they will have been "led out."

Yet this fertile source has scarcely been touched. Potential users of welding are still unaware of its vast capabilities. Tell us about these persons so we can join *you* in insuring golden days in the future.

And let us "Remember September—National Welding Products Month," and make it a month and year the welding industry long remembers.





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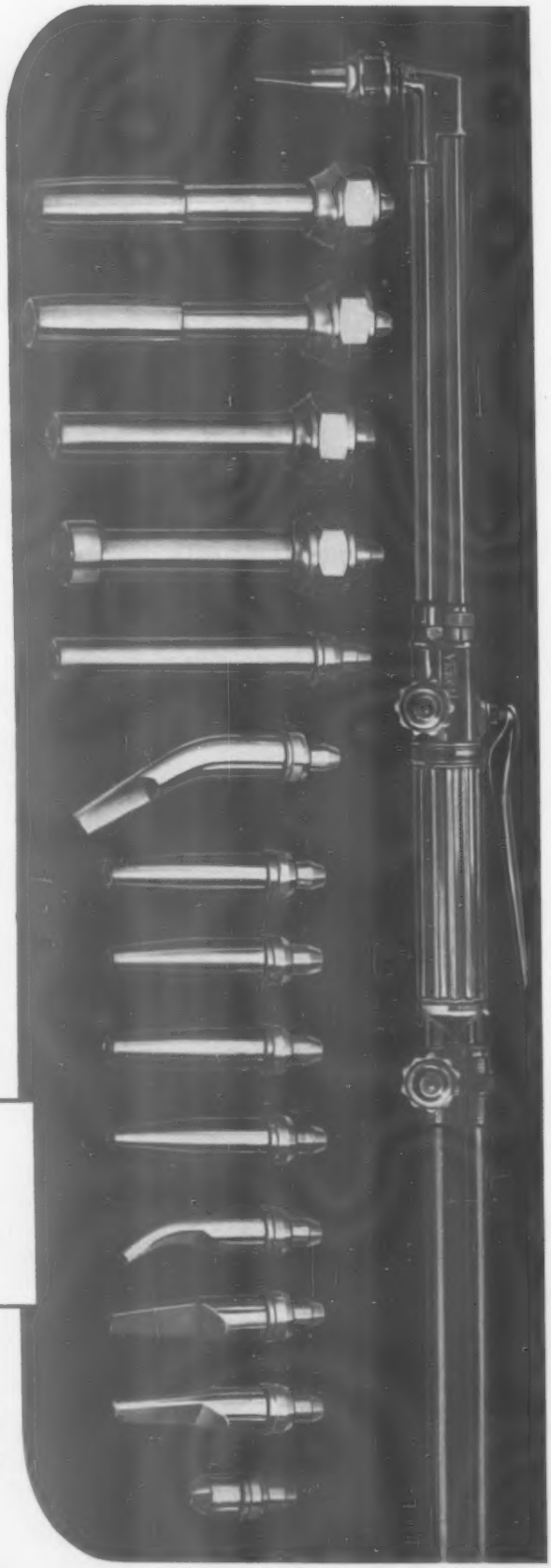

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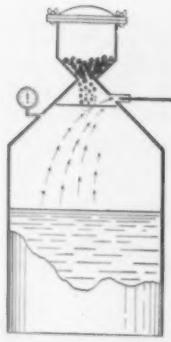


for welding and chemistry . . .

Acetylene's 66-year success forecasts a popular future

By Jack Fairlie

LONG ACCUSTOMED to risky walks down narrow, pitch-black streets, the citizens of 17th-century Paris were understandably delighted when an act of parliament gave them an illumination system comprising 6,500 lanterns.

But the joy of the citizenry—to say nothing of the combined effect of the 1,625 lb of candles burned each evening—would have paled in the bright glow of the acetylene lamp introduced in the U. S. little more than two centuries later.

In an age when the word "light" connotes an incandescent fixture of one type or another, it is difficult for us to appreciate the popular appeal of acetylene as a dispeller of darkness. But late-19th and early-20th century Americans and Europeans considered themselves fortunate to replace smudge, smelly oil lamps with a non-smoking, relatively non-odorous type that burned infinitely brighter.

This, then, was acetylene's initial import to the public. To a smaller, not-yet-organized group, however, it had even greater meaning.

Mixed with oxygen, this gas burned hot—hotter by far than the oxyhydrogen flame used at that time in the Drummond light (the theatre's famed "limelight"). There was obvious potential in this calcium carbide derivative. Men of vision wondered: "Could it heat iron and steel and fuse joints of great strength?"

The answer was just around the corner.

A Matter of Credit

It is to Edmund Davy, professor of chemistry to the Royal Dublin Society, that credit must be given for the discovery of acetylene. Travelling to Bristol, England, in the autumn of 1836, Davy related the story in these words to the British Association for the Advancement of Science:

"Early in the present year the author, in attempting to procure potassium by strongly heating a mixture of calcined tartar and charcoal in a large iron bottle, obtained a black substance which readily decomposed water and yielded a gas which, on examination, proved to be a new compound of carbon and hydrogen.

"This gas is highly inflammable, and when kindled in contact with air burns with a bright flame, apparently denser and of greater splendor than even olefiant gas."

After describing the manner in which the gas is absorbed by water and sulphuric acid—and in which it "detonates powerfully" when mixed with oxygen—Davy mistakenly termed it a "bicarburet of hydrogen" (*carburet* and *carbide* are synonymous—*Edit.*). It remained for the French chemist Berthelot to determine the composition of this gas and, because of its relation to other known compounds, to name it *acetylene* in 1860.

In concluding his momentous report, Davy accurately stated that: "From the brilliancy with which the new gas burns in contact with the atmosphere, it is, in the opinion of the author, admirably adapted for the purposes of artificial light if it can be procured at a cheap rate."

But any hopes for such adaptation had to go a-glimmering; economical electric generating power was not

Carbide manufacturers

There are only four producers of calcium carbide in the U. S., but their combined efforts can turn out well over a million tons of the product annually. In 1956, production reached the 1,024,571-ton level. Figures for the first 8 months of 1957 indicate a production of 667,180 tons—up almost 5 tons over the similar period in 1956. Performance during 4th-quarter '57, however, may have slacked-off slightly.

Here are plants and rated capacities:

	Rated capacity (tons)	
Air Reduction (Nat. Carbide)		
Louisville, Ky.	150,000	
Calvert City, Ky.	300,000	
Keokuk, Iowa	79,000	
Ivanhoe, Va.	36,000	
Total Airco		565,000
Union Carbide (Electromet Div.)		
Niagara, N. Y.	210,000	
Saulte Ste. Marie, Mich.	90,000	
Ashtabula, Ohio	228,000	
Portland, Ore.	32,000	
Total Union		560,000
Midwest Carbide (Shawinigan)		
Keokuk, Iowa	50,000	
Pryor, Okla.	30,000	
Total Midwest		80,000
Pacific Carbide (Portland)		15,000
Grand total rated capacity:		1,220,000

Glossary

Acetone . . . is the colorless, flammable liquid used in acetylene cylinders which is capable of dissolving 25 times its own volume of acetylene for each atmosphere (14.7 psi) of pressure applied.

Air-acetylene . . . is the term applied to the mixture of acetylene and atmospheric air which results in a fairly hot flame that is non-oxidizing, non-carburizing, and suitable for many soldering applications.

Calcium carbide . . . is the end product of a mixture of lime and coke that has been subjected to 5,000 F in an arc furnace, solidified, and ground to lumps of varying size. When added to water, it emits acetylene gas.

Decomposition . . . of acetylene into hydrogen and carbon will occur with explosive violence whenever the free gas is subjected to a pressure greater than 15 lb per square inch and ignited.

Explosive range . . . of acetylene in air ranges all the way from 2.5% acetylene/97.5% air to 82% acetylene by volume.

Filler . . . is the term which describes porous material placed in a cylinder to absorb the acetone in which acetylene is dissolved. Most common fillers now in use are a sand-lime material, a calcium-silicate type, and a charcoal-cement filler. Porosity varies from 83 to 92%.

Generation . . . describes the emission of acetylene gas from calcium carbide immersed in water, and must be accomplished in a generator especially constructed for the task.

Oxyacetylene . . . is a mixture of oxygen and acetylene, the most common of all acetylene mixtures for welding and cutting. When combined in approximately equal amounts, oxyacetylene produces the non-oxidizing, non-carburizing *neutral* flame that is most suitable for a large number of gas welding jobs.

to be the heritage of Davy's generation.

Acetylene gas was destined to remain little more than a scientific curiosity for over a half century, even though in 1862 the German chemist, Friedrich Wohler, produced calcium carbide from the action of high-temperature carbon upon zinc and calcium.

Wohler's method was costly and slow, however, and he is remembered chiefly in the acetylene field for having been the first to use the phrase "carbide of calcium".

Spray, N. C.—1892

In the northern part of Rockingham County, N. C., is the town of Spray, which reported 3,000 occupants in the 1940 census. In 1892, the town rolls probably listed 1,000 names or less. Thanks to the perseverance of an ex-Confederate officer, however, this hamlet became world-famous.

James Turner Morehead, a major in the armed forces of the C. S. A., returned to his home in Spray following the surrender of Joe Johnston's forces at Greensboro, N. C., in 1866. From the day of his arrival, until he was financially ruined in the failure of a state railroad scheme in 1885, Morehead strived mightily to reconstruct a war-ravaged North Carolina.

But along with his bank balance, his cotton and woolen mills, water power plant, grist mill and general store (all sold to pay debts), Morehead did not also sacrifice his initiative. This quality remained with him for all his days . . . leading ultimately to the recovery of his fortune.

One asset—water rights to a stream near Spray—had been retained by the Major. And on the power derived from it depended his success or failure.

Arc Furnace Experiments

Building a small plant on the property left to him, Morehead doggedly embarked upon a series of tests with an electric arc furnace. Joseph Scales, who served as assistant to Morehead at no pay during a later period, describes these trying months:

"In 1887, while awaiting the (financial) smash he knew confronted him, he connected a shaft to an overflow water wheel, extending the shaft across the canal to a shed. This shaft was connected to a dynamo, and in the shed he commenced his early experiments."

Here at last was the relatively cheap but powerful production tool that had been denied Davy 50 years before.

As an assistant, the elder Morehead brought to the shop his son, John Motley, then a chemistry student at the University of North Carolina. Soon thereafter, he engaged the services of a Canadian electrical engineer, Thomas L. Willson. With the latter, he formed Willson Aluminum Co., of which the Canadian, according to Scales, "was nominally at the head". E. F. Price and Jesse King filled out the company roster.

This small band, skating almost blindly on the thin ice of vastly inadequate capital, nevertheless entered confidently upon a period of experimentation. Their dynamo, however, was evidently not the asset it would appear to be.

Though rated at 2,000 amp and 45 volts, "it was never good for more than half its rated capacity," Scales notes. "It was a most inefficient machine to start with, and became more so the longer it was used."

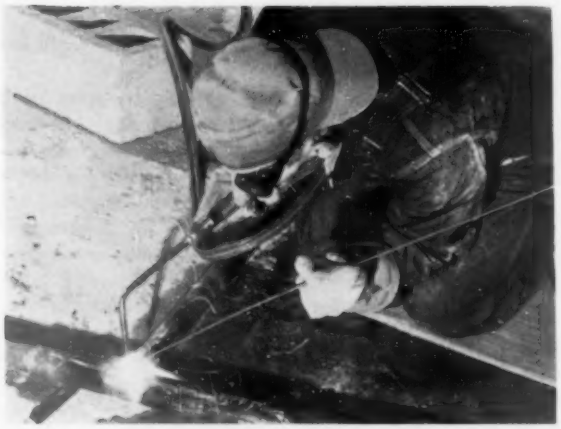
Double Furnace Built

The electric furnace used at Spray also left much to be desired. Here is how it looked to Scales:

"The first electric furnace which Willson designed and built . . . in Spray was the ordinary brick type. It was about 8 ft high with a floor space of 3 ft by 2 ft 6 in. The floor was of carbon, which served as one electrode. The other electrode was suspended, and weighed about 180 lb.

"Since an experimental run required about 2 or 3 hours, and since the furnace had to cool for an equal length of time before the result of the experiment could be determined, there was a loss of time during these waiting periods. This was expensive in labor and power, because the flow of water generating power was continuous.

"To overcome loss occasioned by waiting for the contents of this single furnace to cool, a double furnace of the same design was built. It was in this double furnace that the first practical method of making calcium carbide was discovered in 1892."



MOST common conception of acetylene's use is in oxy-acetylene welding or cutting. But this popular mixture is also used extensively in hardfacing, brazing, beveling, gouging and scarfing—and in heating, forming, hardening, softening and strengthening many metals.

The nature of the group's earliest experiments is unrecorded, but when Charles Martin Hall hit upon the electrolytic process for producing aluminum, Willson felt he could duplicate Hall's results with the electric arc furnace.

Willson thought the electric furnace could produce aluminum in much the same way as a blast furnace produces iron. Confident in this assumption, he first turned the arc heat on a mixture of alumina and coke . . . and failed. Then, to this same mixture, Willson added metallic copper, hoping to produce aluminum bronze.

This latter experiment gave the researchers what they sought—but at too great a cost, and in insufficient quantity.

Despondent over their inability to come up with a metal or compound of any importance, the group kept working, but at a notably reduced pace. And then came the experiment which changed the complexion, not only of work being done at Spray, but ultimately of the entire field of illumination, scientific research and metal-working.

Haphazard Mixture

Placing coal tar and lime in the furnace ("without any regard for theoretical proportions," says Scales), the chemists produced a substance they thought was metallic calcium.

It was their practice to draw any new material from the furnace while still molten, cool it in water, then subject it to various tests. When the "metallic calcium" was dipped in a pail of water, however, it gave off a gas that those present assumed was hydrogen.

A second sample was then immersed in water, but this time when the gas appeared, it was ignited. Heavy smoke accompanied ignition of the gas and, since hydrogen contains no carbon, the experimenters realized that they had a new and unusual substance on their hands.

Quickly identified as calcium carbide—and the gas as acetylene—the product was just as quickly protected by a U. S. patent issued early in 1893. (A later effort on Willson's part to secure European patent rights misfired when the Canadian failed to use the date of his U. S. patent when making application abroad. Thus, French chemist and Nobel prizewinner (1906) Henri Moissan, who had independently duplicated the Willson-Morehead achievement at virtually the same time, retained a right to calcium carbide production in his country.)

Plant Failures

Product and patent notwithstanding, the dual job of producing a high-grade, uniform carbide in quantity *and* finding a market for it placed too great a strain on the already overtaxed finances of Willson Aluminum Co.

With the failure of some of the first five plants set up for calcium carbide manufacture, the Spray group was forced to split.

Price took a position with Westinghouse; John Morehead enrolled in a special school there. Willson went to Canada, and King followed him. (Willson was never to return, though he remained active in the carbide industry all his life. King and Price returned later to accept prominent positions with firms producing carbide. John Morehead accepted the presidency of one of the five original carbide plants, Acetylene Light, Heat & Power Co. in Niagara Falls, in 1896. Two years later, this firm became what is now Union Carbide Corp.; Morehead remained as engineer for the new company, and served also as chief chemist and engineer of tests for Peoples Gas, Light & Coke Co. for many years.)

Did you know . . .

. . . that three U. S. firms—Union Carbide Corp., American Cyanamid Co., and Monsanto Chemical Corp.—are producing acetylene on a large scale from natural gas, and that a fourth, Wulff Process Co. of Los Angeles, procures acetylene from natural gas, propane or ethane?

Many principles of producing acetylene from hydrocarbons by arc cracking were pioneered by Germany's I. G. Farbenindustrie during World War II. A purely thermal cracking method used in the U. S. is known as the Wulff process.

The Niagara Falls plant, together with one in Sault Ste. Marie, Mich., were two of the original five set up by James Morehead that remained in production—and had actually expanded—at the turn of the century. This was due, in large measure, to the development by W. S. Horry of a more powerful electric furnace of greater capacity.

"Like A Wheel"

Horry was a research engineer for Peoples Gas Co., co-developer with the Spray group of the Michigan plant. His furnace is described by George G. Pond:

"This furnace was built like a large wheel with exaggerated flanges. Plates were bolted on the periphery, across the edges of the flanges, and the electrodes were placed in the shell formed by these plates.

"Plates were bolted onto the front just above the location of the electrodes in such a manner as to retain the charge of raw materials which was mechanically fed into

Did you know . . .

. . . that a process for continuous production of acetylene and ethylene from naphtha or natural gas feedstocks is now available in the U. S.? Developed in Belgium and offered by M. W. Kellogg Co. New York, the process produces the hydrocarbons simultaneously.

the furnace. The plates were taken off at the rear and the finished carbide removed. This permitted continuous operation and was more economical in power requirement than the older furnaces.

"One man on a shift tended the furnace, turned it, put on the plates, shoveled in the mixture of raw materials, removed the plates, pried out the carbide, broke it up with a sledge, cleaned it, and packed it into drums."

Electrodes used in this furnace weighed 250 lb or more, and utilized 500 hp. The unit was cumbersome, awkward to work with, and inadequate by any standard of comparison applied today—but it was the furnace that kept the early Michigan plant in operation, and made the Niagara plant the largest carbide manufacturing establishment of its day.

Acetylene Illumination

Just before the fast-moving 20th century came upon the scene, carbide producers and independent scientists had begun to study acetylene's possibilities as an illluminant. First application for the new gas at this time was its use as an enriching agent for the more common water gas.

But, with the introduction of more and larger Horry furnaces . . . the general use of high-purity coke and lime as raw materials . . . and the resulting production of improved and more economical acetylene gas, virtually unlimited usage possibilities sprang into being.

Homes, streets, hotels and factories—to say nothing of schoolrooms, hospitals, vehicles and ships—quickly became the obvious points of use for the bright, clean acetylene flame.

And in France, scientists Fouche and Picard made the year 1901 an unforgettable one for the welding industry. Basing their tests on work done in 1895 by a countryman, Henri Le Chatelier, they mixed acetylene and oxygen—then fed the combined gases through an experimental model of the world's first successful oxyacetylene torch.

It was an improved torch of this type that still another Frenchman, Eugene Bournonville, brought to the U. S. in 1906 to spark this nation's interest in, and rapid development of, gas welding.

As though to aid the seemingly endless application possibilities for acetylene, a new method for extracting carbide from the furnace was developed early in this century. Carbide was *tapped* from the furnace while still molten—as it still is today.

By removing carbide in its molten state, producers were eliminating the costly furnace down-time resulting from the hours lost while waiting for the product to cool; they were, by the same token, increasing production. Best of all, the carbide they now obtained was a better product—free of the waste materials which lay at the top of the molten charge in the furnace, and which had once been removed along with the more desirable mass below it.

In this period of swift expansion, there naturally had to be problems. One of the biggest of these was the shipment of both carbide and acetylene. Carbide—screened for size and packed in well-made drums—reacted only when it came in contact with water.

Numerous destructive tests by manufacturers indicated conclusively to everyone but the Department of Commerce and Labor that the material was harmless when properly packed. And even the Department saw the light in 1907, when it rescinded a 9-year-old order preventing carbide shipment on passenger vessels.

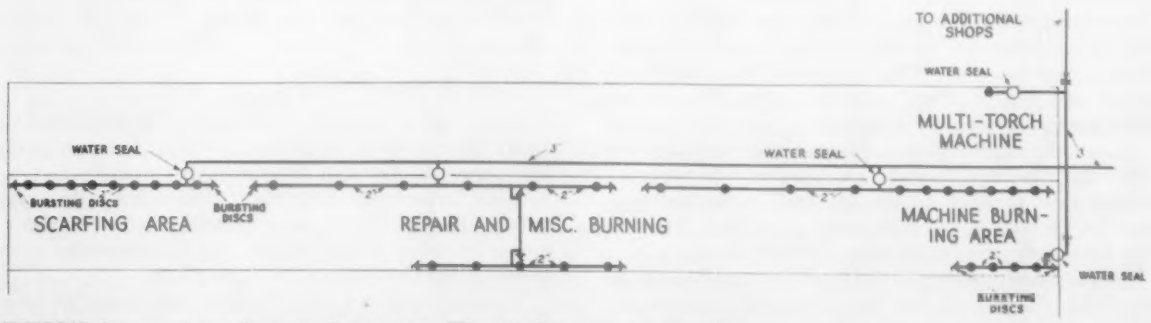
Containers for the acetylene derived from carbide were not quite as easily developed. Until 1904, in fact, there were no effective cylinders, and acetylene for illumination was generally piped directly from generators to the area in which it was used.

The Avery "Tank"

In that year, however, P. C. Avery of Indiana displayed a remarkable development—a portable cylinder containing acetylene gas and designed to power auto headlights—to two of his home state's most famous promoters. James Allison and Carl Fisher, then engaged in auto sales, were immediately interested and, together with Avery, set up a small factory in Indianapolis for the fabrication of this "tank".

Until Avery withdrew in 1906, the shop was known as Concentrated Acetylene Co. It then became Prest-O-Lite Co., and is now the Speedway Laboratory of Linde Co.

As Prest-O-Lite Co., Allison and Fisher had to devote much of their time to plant re-locations into progressively



TYPICAL layout of acetylene pipeline system. "Burning" is synonymous with "cutting."

Acetylene forecast

Welding Engineer's Research Dept. reports an estimated 10% increase in U. S. acetylene production during 1957. This brings total national production of the gas to within a few thousand tons of the half-million mark, and represents a production increase of more than 100% in the past 10 years. Given the favorable circumstances of the past 5 years, acetylene production should continue at an even more highly accelerated rate in the foreseeable future.

larger quarters. It wasn't until 1912 that they built one of sufficient size on what was then the outskirts of town (and across the street from which they constructed the famed motor speedway).

And there were other problems born of acetylene's success in its portable container. Cylinder refilling stations throughout the country were, in the words of an industry pioneer, "beset with explosions and fires, and legislation frequently required that the plants be moved."

Off and Running

The small portion of portable "Prest-O-Lite" acetylene tanks sold to weldors, and torches of the type introduced by Bournonville, were the principal factors that got the new-born gas welding industry off the ground. It actually began to take the lead from other fields of metal joining and severing, however, as carbide production consistently increased, and when—in 1913—the acetylene cylinder similar to that used today was first produced.

Two types of filler material held the acetone and dissolved acetylene in these new cylinders. One was a magnesium oxy-chloride cement type; the other consisted of asbestos discs. (The charcoal-cement filler, a standard for many years, was not developed until 1919. In 1950, a sand-lime material became popular. In January, 1958, Linde Co. announced the development of a lightweight calcium silicate filler with 92% porosity.)

The necessity of a porous substance within a cylinder to stabilize compressed acetylene had first been seen by the French scientist Fouche, one of the men responsible for the oxyacetylene mixture. But filler alone permitted very little gas to be placed in the cylinder.

Experiments by another French team, Claude and Hess, brought to light in 1897 the value of *acetone*. This colorless, flammable liquid, when added to the porous material already in the cylinder, is capable of absorbing 25 times its own volume of acetylene for each atmosphere (14.7 psi) of pressure applied. (Thus, at normal full cylinder pressure of 250 psi and a temperature of 70 F, acetone has absorbed over 400 times its own volume of acetylene.)

Generating the Gas

Given all the "plus" factors of increasing carbide production, improved cylinders, adequate filler materials and safer charging facilities that marked acetylene industry growth through the boom years of World War I and into the even more prosperous 20's and 30's, the industry was still dependent on one very important process: acetylene generation.

Fortunately, the designers of generation equipment turned out units capable of meeting constantly-increasing demand.

Only one of the three principal methods of acetylene generation has ever attained popularity in the U. S.—the carbide-to-water method. There are also the *dry* and the *water-to-carbide* methods. The latter is the most widely used means of generation in Europe; the former is given only limited use in this country and abroad.

Before the transportation of acetylene in cylinders was possible, of course, generating units of all sizes were common sights in every area where acetylene was used. Unfortunately, however, not everyone who bought a generator was expert at operating it. And to complicate matters still further, many wild-catters sold units that all too often were highly dangerous in operation.

Oxyacetylene Automation

It took the combined efforts of the International Acetylene Association and the Underwriters Laboratories of the National Board of Fire Underwriters—plus the cooperation of manufacturers of acetylene generators and other equipment—to halt these "explosive" practices.

The impetus provided by World War I in the development of sound oxyacetylene welding and cutting procedures led also to greater adaptations of the process in production-line operations. And since, in America, production is equated with speed, it was only natural that cutting and welding torches were soon being used with devices that carried the torch to the job—or the job past the torch.

The evolution of oxyacetylene machine cutting equipment has been an almost unbelievable progression from diminutive devices that could carry only *one* torch in *one* direction to electronically controlled tracer-head units that will guide 6, 8 or 10 torches (and sometimes more) in any direction decreed by a paper template.

Looking Ahead . . .

Carbide manufacturers and acetylene producers are now looking toward, and preparing for, future prospects bright enough to make today's advances seem pale.

Though there have been massive developments in the fields of arc and resistance welding, the oxyacetylene process continues to hold its front-running position as the world's most popular maintenance and production tool.

Though both hydrogen and propane compete with acetylene for the user's favor, neither seems likely to give the leader much trouble. The oxyhydrogen mixture—which is even older than oxyacetylene—lacks the very hot flame so necessary on many welding and cutting jobs. Propane, though it may match acetylene's heating "punch", still seems to lack some of the latter's versatility.

Finally, though only about 30% of the nearly half a billion pounds of acetylene now being produced annually is purchased for welding industry use, the remaining 70% is earmarked for use as a chemical raw material. As such, it will continue to be subjected to an almost unprecedented demand in the forseeable future.

This, then, is acetylene—66 years old this year, and one of welding's most reliable fuels . . . and friends . . . for 50 of them.

Welding aids nuclear

MOBILE crane positioning welded-together plates on job site.

IN SCOTLAND—*Welding and weldors help make the atom serve the cause of peace by fabricating a fast breeder nuclear reactor.*

By William A. Heath

AN IMPORTANT STAGE in Britain's nuclear power program will be reached in April when the fast breeder reactor now nearing completion at Dounreay, on the north coast of Scotland, is scheduled to begin operations.

The occasion will attest to the capabilities of British welding methods and techniques, which have developed as quickly and efficiently as that country's nuclear program.

Thermal output of the Dounreay reactor will eventually be linked to a 15 kw electrical generating plant. But its primary objectives are to provide data and experience on the factors and design problems related to fast reactors.

The reactor core utilizes enriched uranium 235, or plutonium, as fuel, and is surrounded with a blanket of fertile uranium 238, or thorium. Power is derived from fission of uranium 235 and uranium 238 in the core.

Heat Exchangers

Core and blanket are completely contained in a stainless steel vessel filled with coolant which removes generated heat by means of heat exchangers. All exchangers are grouped around the core vessel in a massive concrete vault.

Above the concrete shield is a travelling crane which is able to locate or remove the entire core, components, or fuel. The whole construction is enclosed in a steel sphere 135 ft. in diameter—a pressure vessel designed to withstand a maximum internal pressure of 18 psi.

Motherwell Bridge & Engineering Co., specialists in large-scale welded construction jobs, built the sphere. Surface area of steel plate is about 1½ acres; total length of welded seams is approximately 2½ miles.

The completed sphere weighs over 1,500 tons and is almost 20 times greater in volume than any similar vessel in Britain.

Critical Standards

Fabrication standards conformed to the highest critical standards associated with pressure vessel construction. In accordance with British standards specifications, all seams were welded and radiographically inspected.

Steel chosen for general use on the sphere was a low-carbon, medium-manganese type. An exception to this was in the sphere's supporting skirts, which required a higher tensile strength steel . . . plate thickness ranged from 1 to 1⅞ in.

In most instances, edge preparation of the plates to be welded was done in the shop. Edge shaping and bevelling were carried on by automatic three-torch oxyacetylene units.

Plates were then cold-pressed to proper curvature on a 1,000-ton hydraulic press. Except for edges to be welded, all plate areas were zinc-sprayed as the last step before shipping them to the job site.

Limitations on plate size—average: 10 by 18 ft.—were imposed chiefly by transport problems; from the fabrication shop, plates had to be moved 200 road miles to Dounreay.

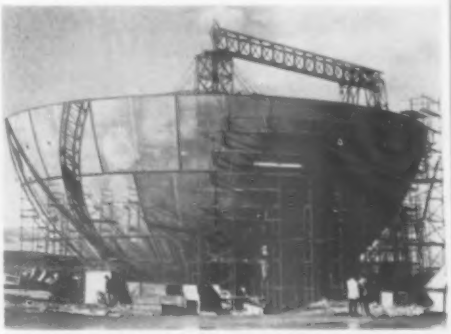
On arrival at the job site, two plates were welded at a time before they were erected.

Because of dampness and other site conditions, it was difficult to attain proper plate preparation and fit-up. For this reason, an automatic arc process, which needed no special drying or cleaning before welding, was chosen.

A self-propelled, trackless, automatic welder that featured wheel steering was used with a special positioner designed to solve the plate curvature problem.

As welding was done automatically, the operator needed only to guide the machine as it fed out its 0.232 in. steel-core electrode wire.

To power this unit, a 1,000 amp generator and an a-c motor were coupled to an auxiliary generator



SPHERE half completed. Weldors work from inside staging.

giving a constant 60 volts for the welder's control circuit. In addition, all generator equipment was enclosed and mounted as a portable unit.

Positioner in a Hangar

An old airplane hangar served to protect the welding positioner against Scotch dews and damps. Two of the 10 by 18 foot plates were mounted on the positioner and the welding machine was swung into position by a crane.

In order to keep welding horizontal and to maintain consistent welding, the curved double panel was tilted progressively and in synchronization with the movement of the welder along the joint.

Both sides of the joint had to be welded. And so, when the front (outer) side had been completed, the

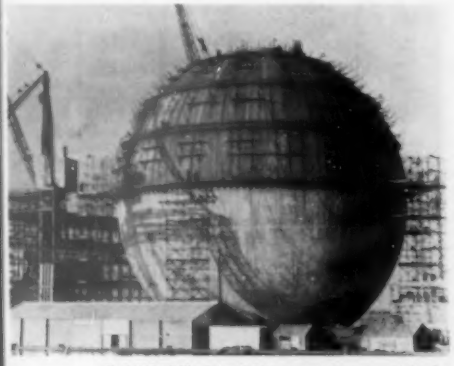
power for civilian use

weldment was turned 180 deg. After back-gouging to the weld metal, the reverse side was completely welded using the same technique.

This technique—when plates were 1 in. thick—was made up of nine passes (four on the reverse side). The root pass was laid at 320 amp with a welding head speed of 16 ipm. Subsequent passes were made at a boosted amperage of 520, but a lower speed—12 ipm.

The reverse side, after it had been gouged, needed only four passes, using the same specifications as the front side.

On 1⅞ in. steel, however, a slightly different procedure was followed. Although the root pass specifications were the same as on 1 in. stock, seven subsequent passes were required at 520 amp with a welding head speed of 12 ipm. After the thicker plate had been turned and back-gouged, nine more passes were made, again at 520 amp at 12 ipm. Thus, a total of 17 passes were required.



DOUNREAY: 135 ft sphere welded for fast breeder nuclear reactor.

Once plates had been welded, they were positioned on the building site by a portable crane.

Site Welding

Actual fabrication welding was done by manual arc using an electrode comparable to AWS E7016, a low-hydrogen electrode.

All portions of the welds were inspected radiographically. Most inspection work was done by 250 kv X-ray units. But where access was difficult, gamma radiography was substituted, using a 10 curie iridium source.

After welding and inspection were completed, joints were prepared for metal spraying through vacuum blasting.

It is comforting for weldors to know that peaceful uses of atomic power—such as that in Dounreay, Scotland — depend a great deal on their skills.

IN THE USA— *Just outside Chicago the world's largest all-nuclear power station nears completion.*

MAJOR CONSTRUCTION of a gigantic all-welded Hortonsphere for the world's largest all-nuclear power station is nearing completion 50 miles southwest of Chicago.

Being constructed by Chicago Bridge & Iron Co., the 190-ft diameter steel sphere will house the atomic reactor for the $45 million Commonwealth Edison Co. Dresden nuclear-power station.

The sphere's 1.25-in. to 1.40-in. thick steel plate sections (A201-B Firebox to A300) are lifted into place prior to welding by a 100-ton derrick mounted on a 210-ft tower. On the tower are a 170-ft high mast and a 135-ft boom.

Specifications

Since the sphere will house an atomic reactor, the material must meet the ASTM A300 specifications, and special impact tests were required of the material, weld and heat affected zones. All welds are 100% X-rayed.

It was necessary to field weld and stress relieve a 16-ft diameter equipment entrance involving 3-in. thick insert plates and a ring forging 6 in. thick. Preheating is required for all joints regardless of weather.

WORKMEN fit two steel shell plates together for a ground assembly at the Dresden nuclear power station site near Chicago.

While all shop welding is manual, field welding is done both manually and automatically. Weldors on the job site use E7018 electrodes with diameters of 1/8, 5/32, 3/16 and 7/32 in., depending on position. Ovens at the job site are used for electrode dry storage.

Power for manual welds is supplied by 400 amp motor-generator and rectifier sets. The average horizontal seam requires 12 to 15 passes, while a longitudinal seam takes 5 passes plus wash beads.

Twin submerged-arc heads are also used in the field, powered by 400 amp d-c rectifiers with 4-in. parallel on each wire. Leading and trailing wires are 5/32-in. diameter mild steel. Only one pass is required on each side.

Multiple-head flame-cutting is used to prepare plate edges in the shop. Arc-air back-gouging is used both at the shop and in the field.

DEVELOPED specifically for the job, a twin submerged-arc welding machine in action at the Dresden nuclear power station. Workman at right removes flux with a vacuum flux retriever.

Over 200 welding engineers, technicians and metallurgists attending the Midwest Welding Conference in Chicago provided an interested audience for this report on . . .

Kaiser's 3 new Mig techniques for welding aluminum

Three new Mig (metal inert-gas) techniques for welding aluminum have been developed by Kaiser Aluminum & Chemical Corp. They are termed the "Qualiweld", *the* "Econoweld", *and the* "Chlorecon" *welding processes.*

THIS WAS THE attention-getting opener used by Kaiser's F. R. Baysinger in presenting a paper on the processes before the two-day Midwest Welding Conference in Chicago.

Speaking at the morning session on January 30, the head of the welding branch of Kaiser's department of metallurgical research told his audience how research work into the causes of porosity and dross in aluminum welding led to development of the new processes.

"Previous investigators conducted many tests relating current range to porosity," Baysinger explained, "and British investigators were able to cause porosity with contaminant additions to the Mig arc. The department of metallurgical research (DMR) went one step further, carrying research into methods for eliminating porosity in Mig welds."

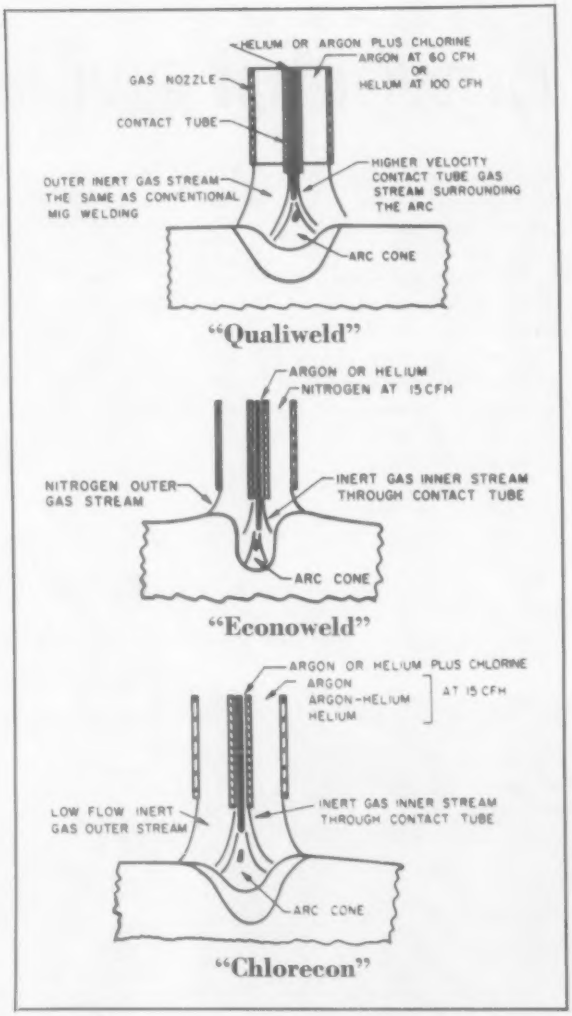
Hydrogen the Cause

Baysinger pointed out that DMR's two years of basic research had "demonstrated quantitatively" that hydrogen is the main cause of porosity in aluminum welds.

"Molten aluminum has a fairly high affinity for atomic hydrogen and readily dissolves it," he said. "On the other hand, solid aluminum can contain very little hydrogen. The gas is rejected as the metal freezes."

He enlarged this point by stating: "if the cooling rate is fairly high, as in a weld, hydrogen cannot bubble to the surface. It is held within the metal as it freezes, forming gas porosity.

"To prove that hydrogen in the arc always causes porosity," Baysinger continued, "tests were conducted in which hydrogen and hydrogen-containing contaminants were added to the Mig arc in varying amounts. These included hydrogen, propane and water-vapor additions to the shielding gas—plus hydrated oxide finishes on the weld wire.



"In every case, with increasing contaminant, there was an increase in weld porosity level."

Below-Standard

As an example, the speaker showed that the addition of just 0.25% hydrogen to an arc brought the porosity level *below* the ASME unfired pressure vessel code's acceptable radiographic standards.

Baysinger explained that "hydrogen in any chemical compound on the filler wire is the main source of this contaminating gas. For example," he said, "if filler wire is processed in such a manner that a hydrated aluminum-oxide film remains on it, extreme porosity will occur in the weld. And hydrogen-containing compounds on the wire, such as oil, drawing compound, or shop grease will also cause porosity.

"Poor welds result from using wire which has been stored for a long time under humid conditions where atmospheric moisture can combine chemically, or be absorbed by the aluminum-oxide film. Weld wire which has been processed chemically in a caustic, then a nitric acid bath, can cause porosity if the nitric acid didn't remove all the caustic. This leaves hydroxide on the wire."

Fig. 1 illustrates Baysinger's point that "there are other causes of porosity in Mig welds.

"First source to be considered," he said, "is improper de-gassing of ingots subsequently rolled into plate or drawn into wire. If ingots aren't properly de-gassed, dross can remain in the metal.

Gas Entrapment

"Porosity in aluminum welding can also result from entrapment of shielding gas in the molten pool—for instance, when excessive current is used with a travel speed that's too slow. The resulting voids are generally irregular in shape," he said.

Continuing, Baysinger stated that "another souce of porosity is the loss of shielding efficiency. Air can be entrained in the inert gas, or a draft can cause momentary loss of shielding.

"Thermal air currents interfere with gas shielding when welding out of position," Baysinger said, "And any of these occurrences will create loss of shielding efficiency and result in weld porosity."

The final cause of porosity revealed in DMR research and cited by Baysinger was contamination "which seems to result from air coming down inside the contact tube."

Dross in Aluminum Welds

Dross—essentially aluminum oxide—*can* occur in aluminum welds.

"It can be formed at the time of welding," Baysinger explained, "or it can come from residual dross in the wire or plate—or from preceding weld beads.

"Excessive oxygen in the shielding gas can combine to form dross . . . and the presence of oxygen in any chemical compound on the filler wire will tend to form dross. Detrimental compounds include hydroxide, such as found in water, oil or grease, or an excessive film thickness of aluminum oxide on the wire.

"Dross has a rather severe effect upon weld ductility and mechanical properties," the speaker continued. "This shows up in tensile and bend tests. Dross does not fuse, but lies as solids in planes."

To eliminate filler wires as a source of hydrogen-caused porosity or dross, Baysinger stressed the necessity of producing weld wire which, at the time of use, is free of hydrogen and oxygen. "The weld wire must also be free of hydrocarbons and heavy oxide films," he said.

Quality Improvements

As revealed by Baysinger, Kaiser's DMR has studied for four years the use of halogen additions to the arc to eliminate Mig weld porosity caused by hydrogen.

"The results from adding chlorine to the argon shielding in Mig welding were favorable but erratic," Baysinger admitted. "In some instances, there was marked improvement in porosity when chlorine was added—in others, the improvement was less than desired.

"We thought it best to develop an improved method of using a small but effective amount of chlorine to assure continuous code-quality Mig welds—and the 'Qualiweld' process was the result."

Kaiser's "Qualiweld"

Explaining this process, Baysinger stated that "a Mig gun was modified so that an argon-chlorine mixture could be introduced through the contact tube in addition

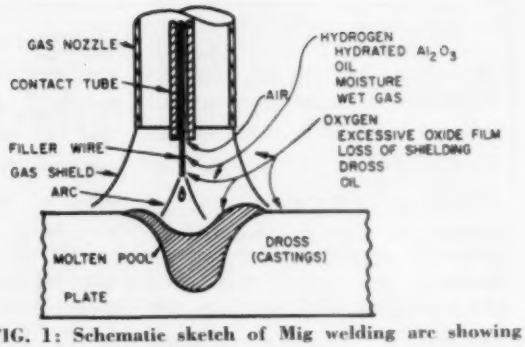


FIG. 1: Schematic sketch of Mig welding arc showing sources of unsound welds.

to regular shielding in the gas nozzle. This carried the mixture directly into the inner arc cone."

Baysinger told his interested audience that this was a more effective method of adding chlorine, and that it gave the researchers "an improvement of from 1 to 3 radiographic grades.

"It was possible to take a wire so badly contaminated that it gave welds that were radiographically sub-standard," he said, "and by using the 'Qualiweld' technique, to bring the quality of the weld deposit within code standards.

" 'Qualiweld' is suitable for welding in all positions," Baysinger pointed out. "Argon-chlorine is used for flat-position welding . . . helium-chlorine for vertical and overhead positions."

Anticipating a question that would surely have been asked later by the audience, Baysinger admitted that Kaiser's DMR personnel had not uncovered the mechanisms involved in chlorine improvement of weld quality.

But he did offer one theory in possible explanation:

Ionization Potential

"With arc voltages between 20 and 32, all common gases could be expected to ionize at their lower potential; nitrogen, chlorine and argon at their second potential.

"Hydrogen ionizes in the arc stream, giving up two electrons to the arc stream or wire. A negative ion such as chlorine must gain two electrons when it ionizes. The chlorine can gain its electrons when it ionizes in the arc column, but must reject these at the molten metal surface when it re-combines.

"It has been suggested," said Baysinger, "that the chlorine forms a film over the molten metal surface which prevents hydrogen from touching the metal. It is possible that hydrogen and chlorine combine chemically—though this is still open to question. Chlorine may also react with the oxide film on the droplet or the molten pool to prevent dross from being trapped in the weld."

Baysinger then cited two questions most frequently asked about chlorine-addition welding: "*What is the effect of chlorine on the operator?*" and "*What is the effect of chlorine on equipment?*"

No Danger to Weldor

"As to the former: using the contact-tube method, we are adding chlorine to the shielding gas in amounts no more harmful than the fluorides present, for example, in the arc atmosphere of a stainless steel metal-arc electrode.

"Regarding chlorine's effect on equipment," continued

Welding Process	Gas Cost/ Arc hr	Position			Material will Weld	ASME Sections 8 and 9		
		Flat	Vertical	Overhead		Radiograph	Tensiles	Bends
MIG-High Flow	$10.00	Yes	Yes	Yes	All	Usually	Yes	Yes
Qualiweld	6.50	Yes	Yes	Yes	All	Yes	Yes	Yes
MIG-Normal Flow	6.00	Yes	No	No	All	Usually	Yes	Yes
Chlorecon	2.00	Yes	Yes	Yes	All	Usually	Yes	Yes
Econoweld	0.80	Yes	No	No	EC	Usually	Yes	No

Baysinger, "we advise that a chlorine gage be used—though all DMR work was done with standard regulator equipment.

"Introducing chlorine through the contact tube circumvents damage to equipment. Copper contact tubes will react with chlorine to form a copper-chlorine compound on the inside of the tube, however, and this compound will eventually cause loss of arc control.

"Thus," said Baysinger, "the tube should be nickel-plated or made of nickel or stainless steel. With nickel-plating, an 8-hour contact tube life can be expected before plating wears through."

Kaiser's "Econoweld"

Jumping to the second recently-developed Mig technique, Baysinger explained that "Econoweld" was the result of research on Mig welding aluminum with little or no argon.

"Nitrogen and carbon dioxide had been studied as possible substitutes for argon in the shielding atmosphere," he said. "But neither gas appeared to be a good shield for aluminum welds used in place of argon in the regular manner.

"It was felt that the contact-tube approach might work with nitrogen if argon were sent through the tube to protect the immediate arc area, and nitrogen covered the remaining shielding area."

Baysinger then provided a sketch which illustrated the principles of argon and nitrogen gas flows through the "Econoweld" nozzle.

"The process at first would deposit good single-pass welds," he continued, "but further passes were impossible because of an impenetrable nitride film on top of the weld."

DMR's breakthrough occurred as the result of an adjustment by a weldor who, "in changing arc length control, found that at the low end of the range the arc didn't snuff-out, but submerged below the weld surface, broke through the nitride barrier and continued welding!"

The speaker said that "Econoweld" can be used on EC, 1100, 3003 and 6061 aluminum. He added that Kaiser does not recommend it for use "on any aluminum alloy containing much magnesium" because of the reaction between nitrogen and magnesium."

Kaiser's "Chlorecon"

Last of the three new Mig techniques described by Baysinger was "Chlorecon". But before discussing the method, he contrasted the three processes.

" 'Qualiweld' is designed essentially for high-quality welding. 'Econoweld' is intended for non-code welding. We felt, however, that it was still necessary to have a low-cost, yet code-quality, process to weld all alloys in all positions." This was the beginning of "Chlorecon".

FIG. 2: Cost and application comparisons for both standard and new Mig processes.

FIG. 3: Kaiser's estimate of costs to weld 1-in. plate are contrasted for firm's two lowest-cost processes and standard Mig method.

	PRESENT MIG METHOD	CHLORECON PROCESS	ECONOWELD PROCESS
	60 cfh Argon	Argon	Nitrogen Argon
Labor & Overhead	$ 5.30	$ 5.30	$ 5.30
Wire	5.77	5.77	6.50
Gas at 33% duty cycle	2.20	0.91	0.27
Cost/hour	$13.27	$11.98	$12.07
No. Feet Welded	5	5	7
Cost/foot	2.65	2.39	1.73
Overall Cost Reduction		9.7%	34%

Basis for the process was DMR test work with low shielding-gas flows. Baysinger revealed that commercial-quality welds in all positions in a draft-free area were obtained with pure-argon flows as low as 15 cu ft. "But," he admitted, "amount of dross present in the weld precluded its passing the code bend test.

"Part of the quality problem in this welding was believed to be due to the contaminating effect of the contact tube. It was felt that the method using argon-chlorine through the contact tube with a flow of shielding gas in the regular nozzle might give better quality welds than low-flow methods through the regular gas nozzle—yet still have low-flow economy."

As a result of many tests, said Baysinger, "it was concluded that a total flow of 20 cu ft of argon-chlorine and argon would produce good weld quality in the flat position. Code-quality welds meeting all bend tests were obtained when filler wire was free of oxygen and hydrogen."

Cost Factors

Baysinger told his audience that Kaiser's DMR had difficulty in obtaining good weld quality in vertical and overhead positions until they used a combination of argon-chlorine in the contact tube and argon-helium in the outer shield.

"This combination gave us code-quality welds in these positions, even though gas flows higher than those used in flat-position welding were required. But these flows," he added, "are still less than those required by conventional techniques."

Fig. 2 represents Kaiser's comparison of what the conventional Mig process and the firm's three new developments will do for the user, and what it will cost him.

Economic significance of the two lower-cost Kaiser processes is contained in Fig. 3, where they are contrasted with the conventional Mig method. Basis for the estimates were contained in Baysinger's statement that, "in the 'Econoweld' process, 5 cfh argon and 15 cfh nitrogen are used. With argon at $0.10 per cubic foot and nitrogen at $0.02 per cubic foot, total cost per arc hour would be $0.80—or a saving of $5.20 per arc hour over conventional Mig welding.

"Savings are somewhat less for 'Chlorecon'," he said. "A total of 20 cfh argon or argon-helium is used at a cost of $2.00 per arc hour. This is a saving of $4.00 per arc hour over conventional Mig welding."

From soup to nuts . . .

Acetylene and carbide have held jobs in almost every field

THE BUTCHER, the baker, (but not the candlestick maker), the botanist, the sculptor and the shoemaker.

These are a few of the lesser-known users who have turned to calcium carbide and its principal derivative, acetylene, at one time or another to solve particularly difficult or unusual problems.

And by the time the first carbide-producing plant was completed at Niagara Falls in 1897, everyone was getting in the act.

Strangely enough, one of the first commercial uses for acetylene sought to make use of its odor. Added to city gas, acetylene would make leaks more noticeable. But it was not economically feasible.

Lighting

Acetylene's brilliance naturally led to its primary use in lighting, the only large commercial use during the first 10 years of carbide production. In 1922 the peak in acetylene illumination was reached with its uses ranging from homes, mines, buoys and lighthouses to automobiles, bicycles, locomotives and even traffic signals.

The last acetylene street light was turned off in 1929, but several hundreds of homes around the country are still using acetylene for lighting, even though the last generator was installed in 1937.

During this period of acetylene lighting more than 580 different types of generators were made and sold. Household appliances, including laundry irons, stoves, hair dryers, hot water heaters and incubators, made use of acetylene.

Blanching celery was another effective use. Strawberry production was increased 25% when natural sunlight was supplemented with acetylene illumination at night. Even more unusual was the placing of a lump of carbide in the heart of the pineapple plant, hastening ripening and improving the crop yield.

Some of these uses are still important in their respective fields, although many of them have been forgotten. Miners' lamps, marine buoys and lighthouses, isolated traffic signals and emergency floodlights will probably continue in use. No method of artificial lighting is ever fully abandoned.

Oxyacetylene flame is seldom thought of in connection with shoes, mainly because leather-edging is not well known. When making high-grade shoes with each piece requiring smooth edges, a small oxyacetylene-heated iron is applied to the back side of the leather. The edges curl back and give that smooth beaded edge.

From Glass To Nuts

In the glass industry, the oxacetylene flame has made some significant contributions, including fire-finishing of boro-silica glass and welding of glass made from quartz.

The reaction of carbide and water has been put to use in processes for dewaxing oil wells, treating septic tanks and thawing water hydrants and railroad switches. Others have used it for killing moles, gophers, prairie dogs and even roots.

While acetylene has never been used to any extent as an anesthetic in this country, except for experiments on animals, it has been employed to a limited extent in Europe. Checking the ability of the heart to pump blood is another medical use for acetylene since it is soluble in blood and can be detected easily. The acetylene flame is also used in the photospectrometer for analyzing blood samples.

One of the most unique uses for acetylene is in the shelling of walnuts. An acetylene and air mixture is blown into the walnut through a hole drilled in the shell and then exploded. The results: a whole kernel and small pieces of shell. This explosive property has also been utilized in an automatic exploder for scaring birds in fruit orchards and in a toy cannon for scaring people.

Hams And Pies

Because the air-acetylene flame is so inexpensive, simple to use and easily portable, it has figured in a number of curious and noteworthy applications outside the generally-known uses.

The flame is often used on wood to produce antique effects, to prevent fungus and mold growth or as a simple wood preservative. It is used for singeing and branding hams, splicing rubber belts, softening floor tiles and flashing suede.

In the food industry it has been found useful for browning the coconut on candy bars and meringue on cream pies. Its most recent use is in the "do-it-yourself" ceramics field for coating copper.

Many of the processes and applications mentioned are being performed today with other fuels. This is no reflection on the value or versatility of acetylene, but rather emphasizes the major contributions of acetylene to industrial progress.

Based on a paper presented by W. B. Browning, Linde Air Products Co., at an annual convention of the International Acetylene association.

WITH flame-flux method, flux flows directly into gas flame, providing automatic supply.

Acetylene brazing need be no chore when flux flows directly through your flame.

Flux in flame finds greater applications

By E. H. Conway
The Gasflux Co.
Elyria, Ohio

IN MANY CONVENTIONAL brazing operations, it is often extremely difficult to restrain operators from using excessive amounts of flux (chiefly in order to make sure of using enough).

Excessive fluxing leads to the accumulation of a hard and adhesive residue on top of the braze; it is also very expensive. Overly-fluxed parts must undergo grinding — jacking costs even higher.

One answer to this economy problem can be found in flame fluxing—a technique which can cut brazing alloy expenditures up to 25%.

Flame-Flux Principles

Flame fluxing utilizes a properly compounded flux held in solution in a highly volatile, flammable liquid, which evaporates rapidly when exposed to air.

A flux container is spliced into the fuel gas line (acetylene, city gas, etc.) supplying the torch or brazing machine. This can be mounted wherever most convenient: shelf, bench, or cylinder truck and requires no changes *in* torches or regulators.

As fuel gas passes through the container, it picks up a regulated amount of flux and delivers it to the torch tip. Thus, flux is in the flame and no surface oxidation is possible because flux is automatically supplied.

When no flux is wanted, a bypass valve permits use of the torch for welding or heating without disconnecting the flux container.

For best results, a gas dryer is often added to the unit to remove entrained moisture when either city gas or generator acetylene is employed for combustion.

Brazing Techniques

Brazing techniques will vary with the nature of the application. In general, however, a neutral flame is preferred; proper adjustment of flux supply can be checked by the correct greenish tinge in the flame.

The area to be brazed must be reasonably clean; it is a mistake to force flux to perform a heavy cleaning job and still expect good results. Heat is important, for a successful braze depends upon proper temperature to permit alloy to flow over the work and spread over the surface.

If the flame is too hot, some alloying elements will boil out and weaken the joint. Especially to be avoided is melting of base metal, which leads to brazing alloy absorption by the parent metal.

On the other hand, insufficient heat will cause alloy to ball-up and roll over the work.

When the alloy is flowing correctly, advance both torch and filler rod at an even pace to maintain uniform deposit width. Usual practice is to point the torch ahead, holding it at 45 deg. and move forward with a weaving motion to avoid overheating the alloy and so lose some of its important constituents (one of the chief causes of porosity).

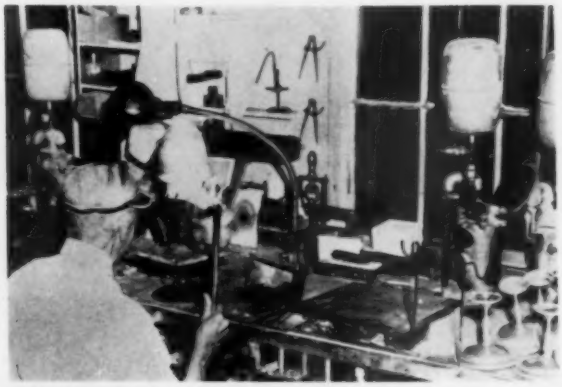
Sheet Steel

Following the suggestions listed above will give good results on most brazing applications. For greater economy, however, and better quality on certain metals, some modifications should be observed.

On sheet steel (containers, cabinets, office furniture), a low-fuming bronze rod should be used. This type of rod does not require close joint fit-up because of its ability to bridge gaps. Nevertheless, a well-fitted joint can be brazed in less time, with less materials, and has a neater appearance.

Adjust flame to neutral and be sure flux is being supplied. Now brush the flame along the joint to

COMPLETELY brazed silver set. Surface oxidation is prevented by keeping metal below oxidation range.



BRAZING silverware with flame-flux method. A soft, low-temperature flame is used.

preheat and preflux the parent metal. When base material begins to show color, warm the rod in the flame.

The alloy should now flow over the the joint, wetting it evenly. Advance the deposit as continuously as possible, making no unnecessary stops or restarts.

If flux supply and heat input are properly adjusted, deposited bronze will be clean, smooth and bright. Any pinholes or porosities indicate heat input probably has been too high.

Sheet Tubing

Sheet tubing, like that used in furniture, bicyles, frames and supports, can also be brazed with a low-fuming bronze rod. Again, the entire joint periphery is prefluxed by flame-brushing. Apply filler metal when base metal turns dull red. Move the torch slightly from side to side so the bronze does not overheat.

Some T-joints are brazed by dropping bronze pellets inside and applying exterior heat. When such a procedure is adopted, dip the end of the T-stem in a saturated solution of boric acid. This will flux the interior portions where flame does not reach. Heat uniformly until brazing alloy begins to exude; then shut off the torch immediately.

Brazing steel tubes with silver alloy demands closer fit-ups to promote capillary action. For this reason, milling of tube ends is recommended. Preformed alloy rings or washers also assist fit-up, especially if brazing heads are machine mounted.

The lower melting point of silver allow permits installation of a smaller tip. With a proper amount of deposited alloy, the resulting fillet will be neat and full with a good color match, needing only a water rinse to remove surface dirt prior to plating.

Copper Tubing

Copper tubing designed for flow lines in refrigeration units and similar equipment most frequently require tube-to-tube T-joints, tube-to-tube telescoping joints, tube-to-bushing butt joints, tube-to-sheet (flat or curved), and tube-to-fittings.

Silver brazing alloys are preferred for steel-to-copper and steel-to-steel joints. Copper-to-copper joints are usually brazed with a phosphorus-bearing copper or with silver alloy.

Even though phosphorus in the copper alloy makes it self-fluxing, flame fluxing is beneficial in preventing discoloration and hardening of adjacent metal.

Choose a torch tip one size larger than would be used for brazing steel of the same section thickness. Under certain joint conditions, a multi-flame tip (two facing tips with a separation to accommodate the work-piece) make possible all-around heating of the tube.

When brazing a telescoping tube joint, take into account the fact that joint fit-ups will prevent flame penetration and, consequently flame fluxing.

Interior Fluxing

One way of making this kind of joint is to brush the male joint member several times with flame to coat it with flux; and then apply a small amount of paste flux to the joint after assembly.

Another method is to spread paste flux lightly on the inside of the female member as far as the male member will reach. This will induce capillary action of the brazing alloy throughout contacting surfaces.

Play the flux-bearing flame around the joint area for preheating and prefluxing. As brazing temperature is gained, begin depositing the alloy. Generally, brazing will be completed in a very short time. To obtain best alloy penetration and to assure leak-proof joints, draw the flame back from the joint along the female member when finishing.

For butt and T-joints, paste flux is not needed. When preheating these joints, however, direct flame more on the heavier of the two parts being joined.

Fittings

Brass spuds or fittings are frequently used when brazing inlet and out-let connections on containers. And joining is best accomplished with a low-melting-point silver brazing alloy. Such alloys will not melt brass and will braze with minimum heat input.

On copper shell, torch tips should be one size larger than those used on steel. Should design requirements call for deep and tightly fitting joints, paste flux is added for full penetration—the secret of leakproof connections.

LEFT: Mitering steel cabinet with flame-flux technique, author states, can cut costs by 25% of conventional methods. Reasons: less flux is needed, a continuous supply of flux is given—without excess, no porosity in braze, fewer rejects, finishing unnecessary. BELOW: Worker brazing steel furniture with a bronze alloy.

NOTE flux-supply line spliced to gas line in center of photograph. Also visible is by-pass for use of torch without flux flow.

Copper fittings must be preheated carefully to prevent heat being conducted from the joint before the alloy flows. "Ball-up" and run-away of the alloy due to lack of heat at the joint cannot be repaired and the brazing sequence must be repeated. In such cases, flame-fluxing offers the advantage of uninterrupted application, and base metal is kept warm.

Cracked Stampings

Cracked steel stampings, including drawing cracks and cracked fusion welds between two or more stampings, can be salvaged by brazing.

There are, however, differences in the nature of the cracks and in brazing procedures. Drawing cracks, for instance, occur at random locations and vary widely in size and direction. These variations can run to ½-in.—and larger—holes to splits nearly ⅛ in. wide.

Wide gaps can be bridged with a low-fuming bronze rod. Using a neutral, soft flame for brazing (increase tip size if necessary), position the stamping for downhand work. Preheating and prefluxing is done by brushing the flame over the metal next to the cracks.

After the metal shows color, apply brazing alloy with a slightly weaving motion to prevent overheating and to leave little or no buildup that must be ground away.

Unlike drawing cracks, fusion weld breaks are usually localized in a small area and are quite small. Many times, however, they are not observed until the stamping reaches buffing machines or until a first plating coat has been applied.

Peening Troughs

Cracks in metals to be plated must be repaired so no sign of them is apparent. Unfortunately, this is no simple task because many fusion cracks are so tight that brazing alloy cannot penetrate and because, after grinding for finishing, the breaks may not be deep enough to accept a strong brazed bond.

Nevertheless, this can be overcome. Peen the crack's top surface along its entire length, forming a relatively deep trough to be filled with brazing alloy. This not only restores the section's full strength but also reinforces the lower side.

Nickel-bronze filler rod should be used, especially if the piece is to be plated. Deposits made with nickel-bronze are dense, match colors very well, and have high bonding strength. An extra advantage is that the deposit does not tend to flatten or pull away while being buffed.

To make the braze, brush work surface with a soft, neutral flame to facilitate wetting. When the parent metal has reached brazing temperature, proceed as described above.

Cast Iron

Broken castings can be reclaimed by brazing with the flame fluxing method, which gives a smooth alloy flow and results in a clean deposit.

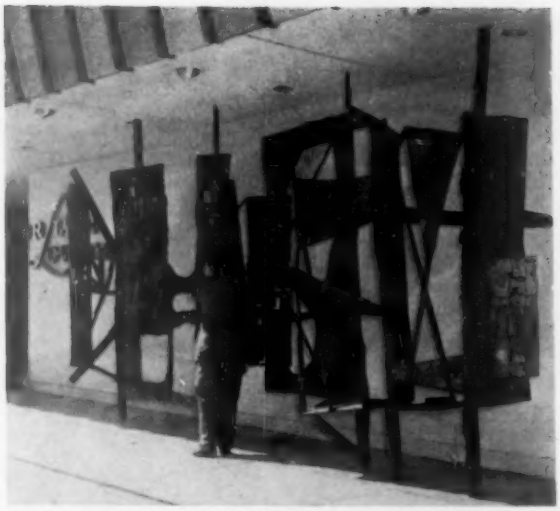
Some large parts will require considerable heating to reach brazing temperatures. On such pieces, clean the work area thoroughly, and coat with a thin paste derived from boiling powdered brazing flux dissolved in water.

With this aid to faster, better tinning, open wide the flux regulating valve on the dispenser to furnish maximum flow before depositing the bronze rod.

A bonus of flux-bearing flames is the prevention of surface oxidation when applying local heat to materials like silverware. Spot-annealing on copper tubes, for example, need not produce oxidation with gas-fired heating elements if the heated portion is immediately passed through a soft, low-temperature, flux-bearing flame.

The flux protects the surface until the metal is below the oxidation temperature point. In operations of this nature, it is unnecessary to make any changes in apparatus or procedures.

It can be seen that flame-fluxing techniques fit very well into brazing operations. In addition, it is worthwhile to study each job and experiment a bit to determine how to get top-quality brazing results at the lowest cost.



SPECTATOR examines welded sculpture. From 800-1,000 lb of brass were welded, at a great saving over casting.

ARTIST Pattison ready to put finishing touches on "The Dynasty." Workroom shows other examples of his talent.

Artist cuts costs by welding

By F. W. Foerste

AUTHOR Walter Pater urged "Art for Art's sake." WELDING ENGINEER, however, recently interviewed a sculptor who changed this to read: "Welding for Art's sake."

The sculptor is Abbot Pattison, a native of Chicago, who added, "Much can be done with welding artistically that cannot be done with any other material."

Although he does not confine himself within the limits of welding—he also creates with marble, wood, and plaster—Pattison feels welding offers flexibility of forms and drastically lowers casting expense.

Dollars and Pounds

He emphasized this economy by pointing out that, by welding a large piece of work, as much as $4,000 can be saved from the cost of doing the same work by casting. Thus he can experiment with form and texture without prohibitive costs.

Latest example of his talent is a large, free form pattern erected near WELDING ENGINEER's offices. Its lightly buffed, lacquered surfaces present a striking contrast to the off-white exterior of the building behind it. This dramatic effect is heightened at night, when spotlights cast grotesque shadows upon the wall.

Nevertheless, much planning and work was poured forth before the 10 by 18 ft pattern was completed. In fact, the artist submitted ten drawings and six models to the architects for their final choice.

Once selection was made, Pattison turned in earnest to actual construction details. Rough slabs of ⅛ in. thick brass were obtained to form the patterns. Patterns were traced on the plates which were than handsawed along the markings.

Brazing for Beauty

About 800-1,000 lb of metal were cut in this way to serve as decorative sections of the structure. To support them, four vertical bars were set into pavement and overhang.

Joining was done with a ⅛ in. bronze rod. Oxyacetylene settings were changed to meet various demands. By welding cross pieces and vertical patterns to two horizontals, a depth of 30 in. was realized. Welded cross members strengthened the structure as well.

Originally, the brass was to have been highly polished. Wall color, however, demanded the work have a dark patina. Some portions were buffed to present highlights to observers, but most onlookers' main impression is of a dully gleaming spider web caught in space.

Plates were textured by puddling weld metal on their surfaces. Last step in the five week job was applying a coat of lacquer over the work.

"The Dynasty"

The Yale-educated artist sculpts in many media but turns again and again to welding because of its freedom.

Typical illustration of this freedom is "The Dynasty," pictured in this article. The statue gives a sensation of spaciousness and sequence of time because of three-dimensional figures on its stages.

To join sections, Pattison used the same rod as on his larger work. A size 7 tip channeled oxygen and acetylene at approximately 10-15 psi. Interesting texturing was placed on figures and supports by puddling and by grinding.

His objections to welding? He had none. But he does need an exhauster to draw off welding fumes which tend to blanket his garage studio, he said.

Is it difficult to make welded sculpture? Pattison answered that by showing WELDING ENGINEER's reporter a stylized statue of a cat his five year-old son had made.

What is the future of welded sculpture? Its popularity is increasing daily as artists and weldors master its techniques. And exhibits of such work around the country have excited interest and admiration from the public.

IAA and *The Acetylene Journal*

By F. T. Tancula

ACETYLENE

At first condemned, its rivals filled with hate,
As view they did its wondrous onward gait,
But sunlight's not a thing with ease maligned,
Nor its young cousin needs from foe be screened,
Swiftly the flame by silent stride moves on;
It suits each taste— it satisfies the throng.

THE ABOVE WORDS, published on the frontispiece to the first volume of *The Acetylene-Gas Journal*, give graphic, albeit melodramatic, evidence of how strongly proponents of the new gas felt back in 1898.

Browsing through the early editions of WELDING ENGINEER's predecessor magazine, a student of our industry's history will in turn be surprised, amused and edified by the editorial coverage given the infant fuel gas.

The *Journal* and the International Acetylene Association will soon celebrate their 60th birthdays. This month the IAA meets for the 58th time (it did not meet in 1915, 1920 and 1938), although the *Journal* ceased to exist as a separate entity in December, 1930, when it was merged with WELDING ENGINEER.

But the *Journal* has a history all its own . . . and its story is closely tied up with that of IAA. . . .

In July, 1898, "the first steps toward an acetylene organization of national character were taken. . . . The meeting took place as appointed and the encouraging number of 15 different acetylene generator manufacturers . . . were represented."

Acetylene Lights Way

At that time, charter members of the International Acetylene Association were not thinking of acetylene as a welding gas. Rather, they were fighting for its greater acceptance as an illuminant. Hence the *Journal's* masthead, which declared it "an illustrated periodical devoted to acetylene lighting and kindred topics."

Today, as the IAA prepares for its 58th convention, acetylene's applications (and its volume of consumption) have increased manifold—but in directions undreamed of by the pioneers of 1898. Its chief uses 60 years later are in welding and cutting and in the chemical industry.

The *Journal* itself was founded less than a year after IAA. Its birthplace was Buffalo . . . its editorial offices in the Caxton building . . . its editor Elias A. Long. At its second meeting in Chicago in 1899, the IAA adopted the new magazine (by this time moved to Chicago) as its official publication—it remained so until the end of 1930.

At that 1898 organizational meet-

TWENTY-FOUR HOUR SUNLIGHT.
FATHER TIME TO ACETYLENE MAN:—"WELL THAT'S CHOICE. IF OLD SOL IS GOING TO GET THESE BRANCH LIGHTS OF HIS ALL AROUND, I'LL JUST HUSTLE OUT THIS OLD LIGHTING TRADE DOUBLE QUICK."

SAFETY OF CALCIUM CARBIDE—SEEING IS BELIEVING.

More than one hundred persons assembled yesterday afternoon at 210 North Liberty street, to hear explained the uses of the new illuminant, acetylene. There were present a number of City Councilmen, several members of the Fire Department, Congressman Frank C. Wachter, representatives of the Electric Gaslight Company and others.

Prof. T. A. Bryan combatted the statement that calcium carbide was a dangerous explosive by concussion. He hammered a piece of the carbide, from which acetylene is made without any effect. Mr. James Hewen also spoke, showing that the dangers attributed to acetylene did not exist.

The city gas burned dull and smoky compared to the pure, steady white light of the acetylene shown, and the compression called forth a hearty round of applause.

THE ACETYLENE FIELD.

CURRENT GLEANINGS—CONDENSED.

ACETYLENE FOR LOCOMOTIVE HEAD...

When engine [illegible] in the combat between Seventh and [illegible] streets and the light was so powerful that heavy shadows were thrown against the court house walls under a brilliant 1,200 candle power electric arc light, the shadow from which was invisible through the rays from the headlight.

The light is far more powerful than that from the electric headlights now in use, even while the rays are not so concentrated, and the radius is more extensive. The finest print could be read at a distance of 800 or 1,000 feet and it is said that on a dark night the light could be seen a distance of at least fifteen miles.

Turned upward, the shaft of light is very distinct and the company is now at work upon an experiment for placing a small reflector directly beneath the flame and a glass in the top of the headlight to throw [illegible] by

Practical, Aggressive, Educational.

This Journal is designed to cover the entire subject of the progress and use of acetylene.

It will devote ample space to general acetylene news and gleanings gathered world-wide. It will give special attention to original articles designed to promote the interests of all users of the new light; as well as to champion the cause of this grandest of illuminants against the unjust attacks constantly appearing.

A leading feature of successive issues will be illustrated articles, along practical lines, that will interest every one who employs acetylene. The article on "Piping for Acetylene Lighting" in the present issue is the first one of this valuable series.

No friend of Acetylene can afford to miss a single issue of the JOURNAL. A large demand for back numbers seems assured, but as the supply of these will be limited, the only sure way to secure the full benefit of the published information is to subscribe for the journal and to subscribe now. The price has been put low to favor an extended circulation.

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CO_2 GAS SHIELDED WELDING

ON WELDING GAS COSTS

CO_2 Metal Arc Gas Shielded Welding costs approximately 1½¢ *per cubic foot of gas!* Even on a limited budget, you can afford shielded gas welding.

How satisfactory is this method? Many satisfied users indicate that the MAGS process produces welds that are equal, *or superior,* to more costly argon or helium welds. This is due to the agitating type of arc, characteristic of CO_2 welding.

How CO_2 Will Benefit You

- Saves over 6¢ on every cubic foot of gas used
- Greater penetration
- Increases metal deposition rate
- Less reworking required
- Increases operator flexibility
- Better appearance

Red Diamond Welding Grade CO_2 is available from all nearby Liquid Carbonic depots.

World's Largest Producer of

LIQUID CARBONIC

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Please send me Liquid Carbonic's complete technical data on new CO_2 shielded gas welding.

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R. C. Swain chosen Morehead Medalist

DR. ROBERT C. SWAIN, vice president in charge of research and development for American Cyanamid Co., will receive the James Turner Morehead medal for 1957.

Presentation will be made during the International Acetylene Association convention in the Bellvue-Stratford hotel, Philadelphia, March 19 through 21.

Dr. Robert C. Swain

The award was made to Dr. Swain for "leadership in developing a commercial process for melamine and related derivatives of calcium carbide." He guided the research team which developed a practical process for melamine resins.

The IAA convention, featuring technical sessions on construction, transportation and safety, will offer nine papers ranging from technology of piping acetylene to various uses of oxyacetylene processes and related safety factors.

The program is designed to appeal to industrial management, engineers and safety technicians in metalworking, chemical, construction and transportation industries. Final feature of the convention will be an inspection trip to the Philadelphia Naval Shipyard on Friday afternoon, March 21.

ing of IAA, George Landis Wilson of Chicago was named president; J. B. Carroll of Chicago, secretary; C. D. Moody of Louisville, Ky., treasurer.

Support of IAA

In reporting that initial gathering, the *Journal* wrote, ". . . the time has now arrived for a strong and liberal advance movement in the interests of the association. Acetylene has reached the stature of a man, seemingly at a leap, and it is due that child-age things be put away. The advantages of organization are too obvious to require extended argument in favor of a strong acetylene association. . . . Coal gas, the electric lighting, the insurance, the transportation . . . interests with which acetylene must cope are each strongly associated."

A strong body did evolve, but Editor Long could not have foreseen how its activities would today be directed elsewhere.

When the *Journal* was founded, its subscription price per year was but 50 cents, and even this low price was halved as an introductory offer, so the new publication might reach its publicized goal of 50,000 subscribers.

Among the advertisers in that first issue were Pan-American Acetylene Co., Buffalo; Monarch Mfg. Co., Indianapolis; and Union Carbide Co. (which had recently changed its name from Acetylene, Light, Heat and Power Co.), New York and Chicago.

By the time the IAA met for the second time in Chicago, in 1899, "the scope of the Association was extended to include, in addition to manufacturers of gas generators and carbide, manufacturers of burners and other acetylene supplies, as well as scientists, investors, salesmen, and others by providing an associate membership."

On To Chicago

Early in 1900, the *Journal* moved its offices to Michigan and Adams in Chicago, and an editorial hailed it as "progress: the *Journal* takes a great stride forward. It means increased usefulness, absolute independence . . ." Not long afterwards, the office was moved to 341 Dearborn St.

A great deal of the early editorial material concerned itself with the

IAA Past Presidents

1898-1900—G. L. Wilson
1900-1901—Raphael Herman
1901-1903—G. L. Wilson
1903-1904—J. B. Carroll
1904-1905—Augustine Davis
1905-1906—Giles W. Mead
1906-1907—H. I. Gannett
1907-1908—A. C. Einstein
1908-1909—M. J. Carney
1909-1910—O. F. Ostby
1910-1911—B. O'Shea
1911-1912—A. C. Collins
1912-1913—P. A. Rose
1913-1914—M. Kirchberger
1914-1916—J. M. Morehead
1916-1917—A. F. Jenkins
1917-1919—J. T. Earl
1919-1921—H. S. Smith
1921-1922—J. A. Johnson
1922-1923—David Ahldin
1923-1924—E. L. Davis
1924-1925—W. S. Noyes
1925-1926—R. A. Sossong
1926-1927—W. A. Slack
1927-1928—L. E. Ogden
1928-1929—L. F. Loutrel
1929-1930—C. A. McCure
1930-1931—W. D. Flannery
1931-1932—W. C. Keeley, Jr.
1932-1933—E. J. Hayden
1933-1934—H. B. Pearson
1934-1935—Philip Kearny
1935-1936—C. O. Epperson
1936-1937—C. D. Gibson
1937-1939—Elmer H. Smith
1939-1940—H. P. Dolisie
1940-1942—Henry Booth
1942-1944—Ellsworth L. Mills
1944-1947—G. O. Carter
1947-1948—R. B. Swope
1948-1949—J. J. Lincoln, Jr.
1949-1950—A. J. Fausek
1950-1951—C. E. Monlux
1951-1952—James W. Dunham
1952-1953—L. W. Hench
1953-1954—W. A. Brown, Jr.
1954-1955—E. A. Daniels
1955-1956—Carl Bode
1956-1957—C. McL. Pitts
1957-1958—Eugene Easterly

This process vessel for the chemical industry, fabricated by Colonial Iron Works, was welded with Arcaloy 309 Lime electrodes. The clad material is 304 on A 285 Grade C steel plate, 3/8" thick. Because of variances in thickness in the plate material, Mr. Weber deemed mild steel back up welding as impractical and costly, thus Arcaloy 309 Lime was used for the entire joint on all girth seams.

All nozzles are 304 stainless steel. Approximately 1200 pounds of Arcaloy 309 Lime were used for seam joints and nozzle fittings.

Critical welds demand the quality of

ARCALOY

STAINLESS STEEL ELECTRODES

Stainless steel or stainless clad material is used on critical applications for its corrosion resistance and high strength properties. The nation's leading fabricators specify Arcaloy stainless steel electrodes to retain these properties and to safeguard their reputation.

Bill Weber, Welding Engineer at Colonial Iron Works, Cleveland, Ohio, has relied on Arcaloy electrodes for many years because he knows he gets the quality of weld metal required for critical stainless welds. He knows that he can depend upon the quality always and in any of the more than thirty different analyses of stainless electrodes made by Alloy Rods Company. He knows that his distributor, Scott-Tarbell, Inc., can meet his requirements with "always fresh" electrodes, because they are hermetically packaged in metal to safeguard freshness and quality.

Your Alloy Rods Company representative or distributor has the knowledge and products to meet your stainless steel welding requirements. Give him a call or write direct requesting Bulletin AR-10. Alloy Rods Company, P. O. Box 1828, York 2, Penna.

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Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

NO FINER ELECTRODES MADE . . . ANYWHERE

Morehead Medalists

1922—Heirs of James Turner Morehead
1923—Noah Esron Wagner
1924—Edmond Fouche
1925—Augustine Davis
1926—Underwriters' Laboratories
1927—Herbert L. Whittemore
1928—Samuel Wylie Miller
1929—John Burlin Johnson
1930—A. Cressy Morrison
1931—Nils Gustaf Dalen
1932—Rev. Julius A. Nieuwland, C.S.C.
1933—Robert Allen Witherspoon
1934—Worthy C. Bucknam
1935—David S. Jacobus
1936—H. Sidney Smith
1937—John J. Crowe
1939—Otto C. Voss
1941—Harry E. Newel
1943—Charles E. MacQuigg
1945—Vice-Admiral H. L. Vickery
1946—Harry A. Campbell
1947—Albert McMillan
1948—Herman Van Fleet
1949—James I. Banash
1950—M. Keith Dunham
1951—Charles Ness
1952—Arthur J. Fausek
1953—Pierre Phillipon
1954—Augustus B. Kinzel
1955—Dr. George V. Slottman
1956—L. W. Stettner
1957—Dr. Robert C. Swain

competition among acetylene, kerosene and electricity as a means for illuminating streets and buildings.

But the *Journal* wasn't alone, for many of the IAA *Proceedings* for those early years are replete with papers that defined the illuminating "advantages" of acetylene over competitive means.

With the July, 1902, issue *The Acetylene-Gas Journal* became simply *The Acetylene Journal.*

Robert W. Hume became managing editor of the *Journal* with the March, 1916, edition. (Mr. Long had been editor all this time, though incapacitated since 1914). The magazine's masthead had been changed to read, "Devoted to welding, lighting and metal cutting."

In an editorial entitled, *The Journal's Triple Alliance*, Hume wrote "In this age of specialization, few people do three things well. The *Journal's* Triple Alliance of Acetylene Lighting, Welding and Metal Cuttings, however are branches of the same tree. The parent stem is Artifice in the use of Acetylene. Acetylene Lighting flourished first. Next came Oxyacetylene Welding of Metals. Third came Oxyacetylene Cutting of Metals.

"Born of the same genius, nurtured by the same experience, tended by the same hands, each in its particular field attests and sustains the lifelong leadership of the *Journal* for integrity of expression and fidelity to the interests of the Allied Acetylene Industries."

The Good Old Days

Another editorial announced a raise in subscription rates—from 50 cents to $1 per year.

In April, 1916, the *Journal* began to identify itself on the cover as the "Official organ of the International Acetylene Association." A month later, the editor wrote ". . . as the college athlete emblazons the initial emblem of his alma mater on his proud chest, so always should the *Acetylene Journal* have held aloft its sign of highest award. Though a standing notice of its responsibility has always appeared on the publisher's page, that has not been enough. *Out front* is where such an insignia belongs; and, henceforth, that's where the *Journal* will always wear it. Turn to the cover!"

In the meantime, the association was also prospering and *Journal* coverage of it increased.

Another man was appointed to lead the *Journal* in September, 1919. Harold W. Cook replaced Hume, who resigned to take a job with another publication. Cook, who had been advertising manager before entering the army, himself was replaced in June, 1923, by Stuart Plumley.

Even as late as then, the acetylene industry was still fighting its losing battle with the electric light bulb.

The December, 1922, issue of the *Journal* reported on that year's IAA convention, held in October in Chicago. That year, the first Morehead Medal was awarded—to the estate of James Turner Morehead.

The annual IAA award has since become internationally famous. It was established in 1922 by John M. Morehead in honor of his father. The medal is presented to the person judged to have done the most to advance the acetylene industry or the art of producing or utilizing calcium carbide or its derivatives.

1922 Election

That 1922 convention elected as IAA president David Ahldin, of Commercial Acetylene Co., New York City, to succeed J. A. Johnson, Johnson Acetylene Co., Crawfordsville, Ind. E. L. Davis, of Acetylene Stove Mfg. Co., Cleveland, was named vice president, while A. Cressy Morrison, of Union Carbide Co., New York City, was re-elected secretary-treasurer.

Early in 1927, Plumley left the *Journal.* (By this time the offices had been moved to 53 W. Jackson Blvd., and the subscription price was now $2 per year.) His successor was M. S. Hendricks, who occupied the managing editor's chair until the merger with WELDING ENGINEER.

Both Plumley and Hendricks still live in the Chicago area. The former is retired and resides in Winnetka, Ill. Hendricks lives in Libertyville, Ill.

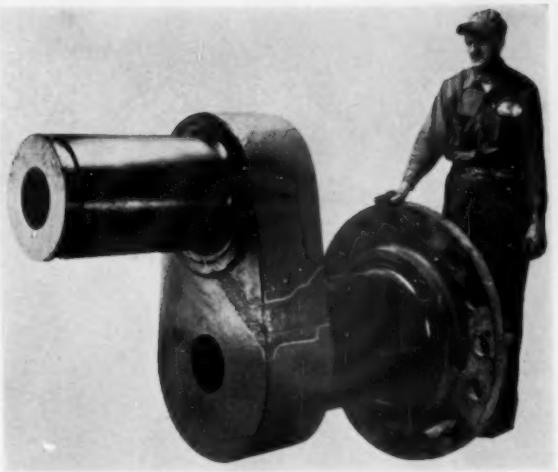
Although the International Acetylene Association has had six secretaries, two of them have served a total of 51 years. The late A. C. Morrison held office from 1907 until 1931, when he was awarded the Morehead Medal. He was succeeded by Herb Reinhard of Linde Co., who has continued in that office through today . . . and is expected to be re-elected this month.

The other four secretaries were J. B. Carroll (1898-1903), G. W. Mead (1903-1904), N. L. Litten (1904-1905), and L. S. Bigelow (1905-1907).

Presidents of IAA are listed in a box accompanying this article.

The last regular issue of the *Journal* was published in December, 1930. An editorial announcing the merger with *WE* stated "The combined editorial staffs bring to the new order of service a background of years of intimate contact with the welding industry and its problems, knowledge of the needs of the reader, and skill in serving those needs . . . the industry can be assured of an enlarged, improved and better organized service."

A big break again proves



REPAIR welding on this walking crankshaft saved company $6,500. Note size of crankshaft compared to worker. Job required 350 lb of weld metal.

Welding is efficient as a maintenance tool

ANOTHER BIG break for welding occurred at the Sunnyhill Coal Co., New Lexington, Ohio, when a 5 ton, 24-in. diameter walking crankshaft fractured during strip mining operations.

Used to drive a 13½-yd, 450-ton dragline power shovel, the crankshaft is a cored steel casting with 0.25% carbon. A replacement shaft would have cost the company $8,000 and taken six months to deliver and machine.

Repair welding by Maintenance Engineering Corp., Pittsburgh, Pa., brought the cost down to $1,500 and held production loss to a minimum. A carefully balanced combination of joint scarfing, preheating, welding on a predetermined steel thickness, and stress relieving at 1,150 F was required. This cycle was repeated until the joint was filled.

Approximately 350 lb of weld metal was used. Manual arc weldors, using 3/16- and ¼-in. E6016 low-hydrogen electrodes, laid down some 60% of this total.

Balance of mild steel filler metal was applied by semiautomatic submerged-arc welding. Electrodes, filler wire, flux and "Squirt" welding equipment were products of Lincoln Electric Co. Current was furnished by a 500-amp a-c/d-c welder.

In preliminary preparations, "pillars" of the original faces were left by scarfing torches for the first weld metal layer. After several cycles, these pillars were scarfed away and the joint was completed. Alignment accuracy was within 15 mils, easily meeting operating tolerances.

To detect any internal cracks, magnetic particle inspections were carried out on each weld layer both before and after stress relief. If defects were found, the layer was removed and rewelded, since the fracture would progress only to the next stress-relieved layer.

Specially designed charcoal-coke furnaces were fitted over the shaft for preheat and stress relief. The finished weld surface required no machining and was hand dressed by portable grinders.

Maintenance Engineering has repaired fractures in steel mill, mining and metalworking equipment with this "cyclic" welding procedure, some repairs requiring as much as 750 lb of weld metal.

PROBLEM WELDING?

Use P&H Low-Hydrogen Electrodes

P&H Low-Hydrogen electrodes give you industry's widest choice of alloys for welding "difficult" steels. There's a chemical analysis to match most parent metals.

Welds are of X-ray quality, with greater ductility at high tensile strength, and better impact properties. For more detailed information, write for Bulletin R-29, Dept. 301B, Harnischfeger Corp., Milwaukee 46, Wisconsin.

HARNISCHFEGER
P&H WELDERS • ELECTRODES POSITIONERS

ASK THE MAN BEHIND THE GLOVE . . .

He'll tell you that
***Carol*® DYNAPOWER WELDING CABLE**

is the best because of its exceptional flexibility, extraordinary strength, extra-long life . . . and it is readily available from a network of warehouses across the country. Furnished on 500 or 1000 ft. "no-charge" reels or in coils.

When you call for cable — call for Carol.

MEMBER NATIONAL WELDING EQUIPMENT MANUFACTURERS ASSOCIATION

Carol®

CAROL CABLE COMPANY
Division of the Crescent Company, Inc., Pawtucket, R. I.

MERCEDES-BENZ 300SL sports car has welded, tubular space-frame like those used in aircraft for strength, rigidity, and silence.

Europe paces unit-body race

DURING A VISIT to the Chicago auto show, a WELDING ENGINEER reporter became convinced that American automobile manufacturers are lagging behind their European competitors in use of unitized welded construction.

Despite extra strength, rigidity, and silence given by welding chassis to frame, only American Motors and some Ford products utilize the method.

In England and on the continent, however, the exception is *non-unitized* automobile.

An increase in its popularity is apparent as Ford initiates the method for its new, four-passenger Thunderbird and its Lincolns. "But when," ask many U.S. car buyers, "are we going to have unitized construction in low-priced models?"

ABOVE: Rambler American features unitized construction in attempt to combine European economy with U. S. design. BELOW: French Renault 42CV. A rear-engined car, this is one of the continent's most inexpensive, popular models. Yes, it has unitized construction.

BURDOX SETS THE PACE

18-wheeler long distance liquid oxygen transport truck.

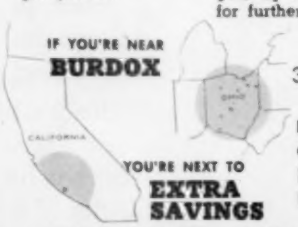
IN LIQUID OXYGEN

AND INDUSTRIAL GASES

This new BURDOX Liquid Oxygen Cylinder holds the equivalent of 10 gas cylinders.

To meet the tremendous increase in industry's demand for oxygen and other industrial gases BURDOX has built two million-dollar plants specifically designed for the production of liquid oxygen and other industrial gases. One of these streamlined, glass and steel structures, housing the most modern and scientifically efficient equipment is located on Cleveland's lake shore. The sister plant is nearing completion at Santa Fe Springs, California.

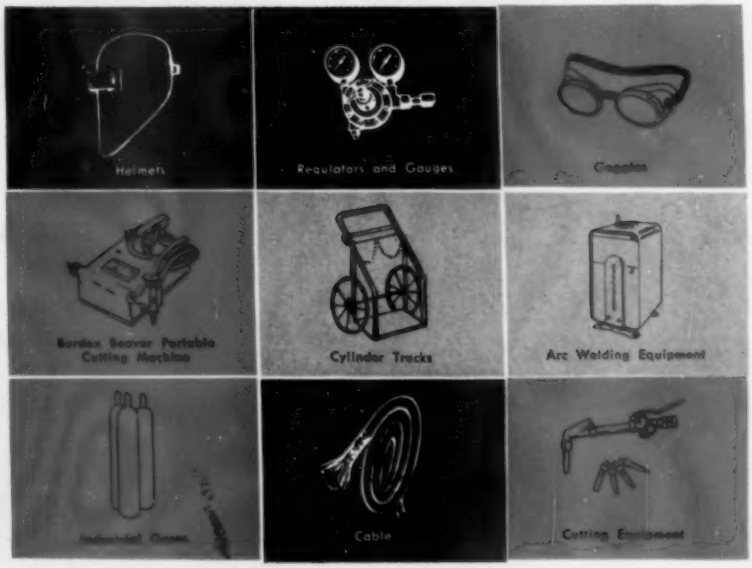
From these two great modern plants will come truckloads of pure liquid oxygen which will provide users with multifold savings in shipping, storing and handling of gas cylinders. If you use oxygen, hydrogen, argon, helium or any industrial gas, by all means call your nearest Burdett representative for further details.



THE BURDETT OXYGEN CO.
3302 Lakeside Avenue Cleveland 14, Ohio

PLANTS and BRANCHES
Cleveland, Akron, Cincinnati, Dayton,
Findlay, Columbus, Mansfield, Youngstown, Ohio
Los Angeles, Santa Fe Springs, California

EVERY PRODUCT...EVERY PROCESS...TO FIT EVERY PURPOSE BEST



Welding Engineer's FACT FILE Issue

Angus MacWeldor, a thrifty Scot
For hit-or-miss ads, he cared not.
He wanted to advertise
Where buyers would scrutinize,
So WE's FACT FILE *hit the spot!*

"It's a fact, Mac," said the

"You won't be sticking out your neck by advertising in "Welding Engineer's" Mid-June FACT FILE issue. It's the biggest bargain in the welding industry."

But Angus MacWeldor, as parsimonious an ad manager as you'll find in the world of weld, was not a man to be easily convinced. Like all good, frugal ad men, he wanted to be sure all the hard-earned dollars he spent on advertising paid off in swelled sales. He wanted quality **and** quantity.

"You've hit the jackpot," said the jocular giraffe. "A once-a-year windfall!" Every day of the year this FACT FILE issue sits right on the desk of important men in the welding industry — pinpointing the very men who will buy your product.

"It's the original directory for the welding industry, you know. And between you and me, Mac, the most complete.

"Every day or so your prospective customer flips through his FACT FILE issue, and there, right before his eyes—your ad. How can he miss it?

"Besides being in use from June till June, this FACT FILE is sent to both "Welding Engineer" and "The Welding Distributor"

giraffe to the Scotsman.

subscribers, adding an extra 5,000 circulation.

"You can't believe it, you say? Of course rates are the same as for a regular "Welding Engineer" ad.

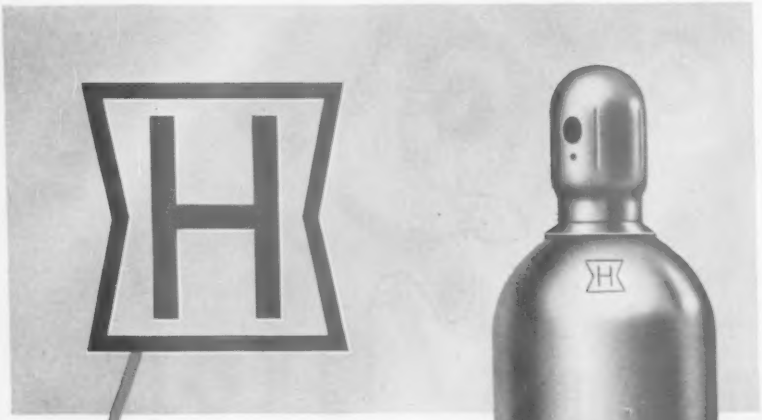
"Between the magazine's extra-durable covers (made to stand up under many leafings) is a wealth of information—data sheets to cover "on-the-job" problems, product listings that are alphabetized, a bibliography covering top welding articles of 1957-58, besides a listing of trade names and names and addresses of manufacturers.

"This year's big editorial feature will tell you everything you need to know about "Weldable alloy materials," besides other articles—timely, yet of lasting interest.

"How do I know people read it? Easy. WE Publications, Inc. had to have 6,200 reprints made as a result of last year's issue.

"What's more . . .

"Say nae more," said the satisfied Scot. "I ken ye, but I dinna have time to listen, giraffe. With the May 20 FACT FILE closing date, I canna afford to wait another minute."



Hallmark of Quality

HARRISBURG CYLINDERS

This trademark is your stamped guarantee of the highest quality high pressure gas cylinders obtainable. Harrisburg is the oldest and largest manufacturer of gas cylinders. From the beginning, durability has been of prime importance. When Harrisburg produces cylinders of either light weight chrome molybdenum steel or standard weight manganese steel it's done with an assurance of long service life and the ability to withstand hard use. This is why keen buyers always use Harrisburg cylinders.

More than a Century in Harrisburg 8, Pa.

HARRISBURG STEEL CO.

Division of HARSCO CORPORATION

TUBES

TRANSPORTS

FLANGES

COUPLINGS

Thanks to welding fittings, there are . . .

No more leaks in this welded pipe

POLYETHYLENE manufacture requires a leak-proof, non-corrosive piping system—partly because of process volatility, but mainly to prevent product contamination.

The anti-corrosive nature of stainless steel dictates its use in the field, and both safety and cost demand a welded piping for utmost dependability.

Engineers at Koppers Co.'s polyethylene plant in Kobuta, Pa., knew that schedule 40 stainless pipe with conventional threaded fittings could solve corrosion problems. But they wanted to avoid costly joint leakage, and threaded joints *are* troublesome.

Doubly Difficult

Stainless is difficult to cut; preparation of a smooth thread is time-consuming, and leaks can be expected at every joint. The separation of threaded pieces of stainless is almost as difficult as the original joining, so to the possibility of mechanical or human error is added the chance of material failure.

With conventional pipe, the engineers also realized they were purchasing excess material. Threading reduces wall thickness approximately 50%—representing a material waste of that much at every joint.

The answer for Koppers was light-wall stainless pipe. Lengths of schedule 5 or 10 are now joined directly by welding, or by bolting in areas subject to future change. The new fabrication method has reduced material needs, cut installation time 70% and eliminated leakage.

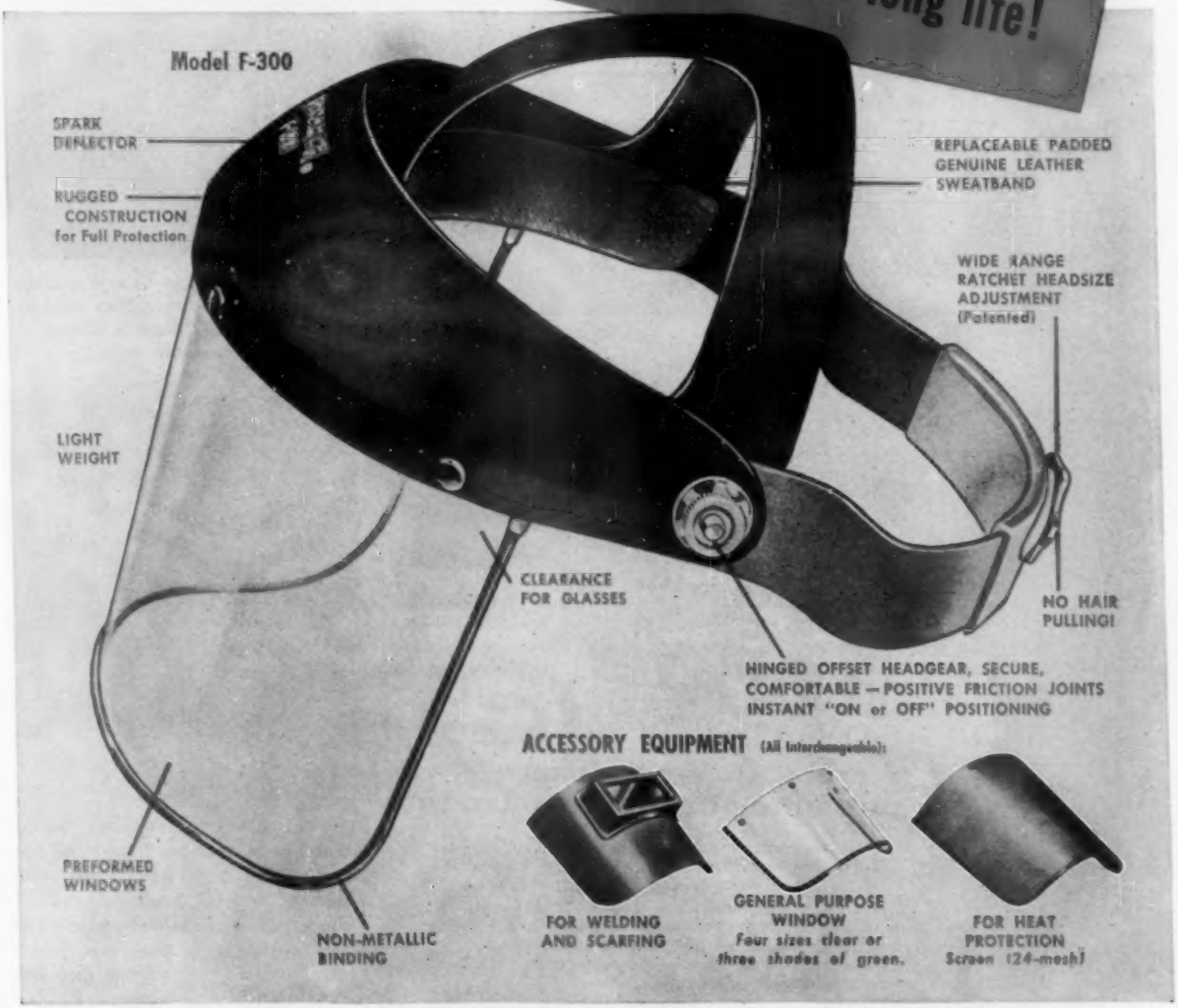
100% Repairs

Use of welding and light-wall stainless pipe are not new innovations at Koppers. When threaded

FIBRE-METAL

Monarch® FACE SHIELDS

. . . give you EVERYTHING for safety and long life!


Model F-300
SPARK DEFLECTOR
RUGGED CONSTRUCTION for Full Protection
LIGHT WEIGHT
PREFORMED WINDOWS
NON-METALLIC BINDING
CLEARANCE FOR GLASSES
REPLACEABLE PADDED GENUINE LEATHER SWEATBAND
WIDE RANGE RATCHET HEADSIZE ADJUSTMENT (Patented)
NO HAIR PULLING!
HINGED OFFSET HEADGEAR, SECURE, COMFORTABLE — POSITIVE FRICTION JOINTS INSTANT "ON or OFF" POSITIONING
ACCESSORY EQUIPMENT (All interchangeable):
FOR WELDING AND SCARFING
GENERAL PURPOSE WINDOW
Four sizes clear or three shades of green.
FOR HEAT PROTECTION
Screen (24-mesh)

COMFORTABLE AS AN OLD HAT, this Monarch® F-300 Face Shield gives you ALL that Fibre-Metal's long and successful experience in designing and engineering really practical protection can deliver. It is economical because of Fibre-Metal's large and efficient production equipment and methods. You get more because of its comfort and durability . . . and versatile safety uses! Maximum safety to eyes and face bring peace of mind, better and more profitable workmanship. Be sure your face protection is by FIBRE-METAL!

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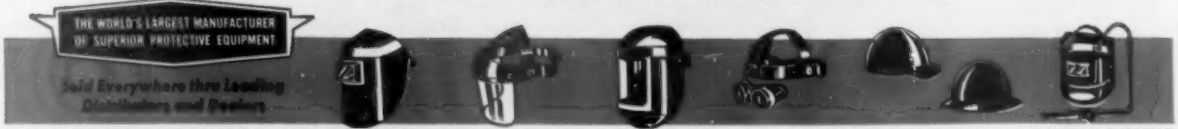
THE FIBRE-METAL PRODUCTS COMPANY CHESTER, PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF SUPERIOR PROTECTIVE EQUIPMENT

Sold Everywhere thru Leading Distributors and Dealers



WELDING HELMETS • FACE SHIELDS • SAFETY HELMETS • HEAD REST GOGGLES • SAFETY CAPS & HATS • FRESHAIR SYSTEMS

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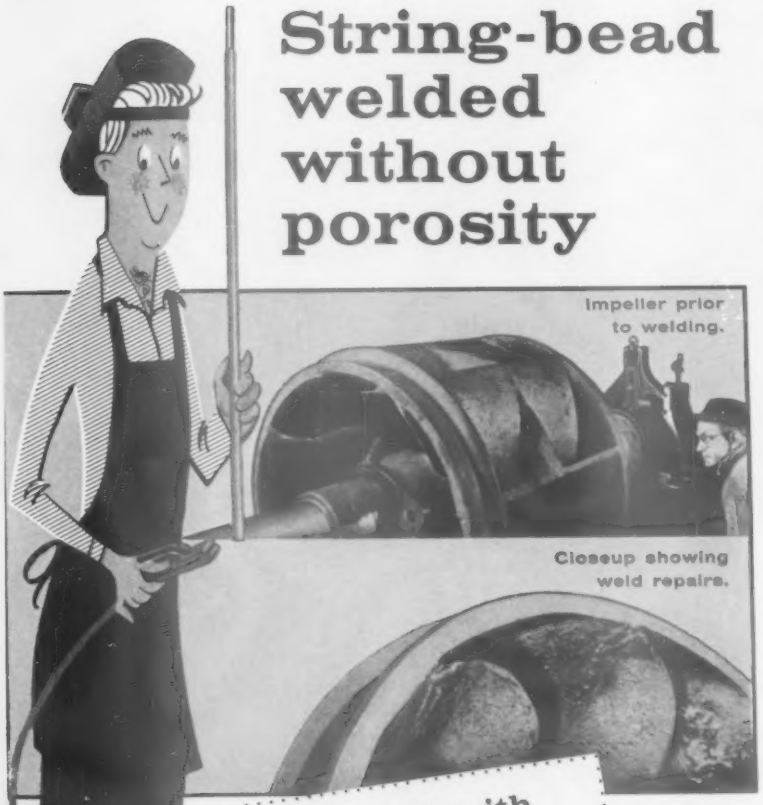
String-bead welded without porosity



Welded with Phos-Trode

Ampco's all-purpose phosphor-bronze electrode

Single-and multiple-layer welds were applied to this large centrifugal-pump impeller. Deposits were free from porosity and slag inclusions.

That's the rule with Phos-Trode. It also reduces spatter, permits fast deposition. Beads are flat and smooth. You get high-quality all-position welds on difficult metals — dense deposits with high mechanical properties.

Use Phos-Trode for overlays and general maintenance and repair welding. Order from your nearby Ampco distributor. Or mail coupon below today.

Sole producer of genuine Ampco Metal

AMPCO®

AMPCO METAL, INC.,
Dept. WE-3, Milwaukee 46, Wisconsin
West Coast Plant: Burbank, California

W-143

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Dept. WE-3, Milwaukee 46, Wis.
Send me Bulletin W-17 concerning further information on Phos-Trode and other Ampco electrodes

Name_____
Company_____
Address_____
City_____ Zone____ State_____

PLANT inspector views new installation of stainless pipe. Note welding fittings, one of which is shown in enlarged view below.

pipe began to leak, welding sealed the joints—in some instances, *all* the joints. Delays and higher labor costs were an obvious result.

And, when light-wall pipe was given a trial some time ago, joints were unsatisfactory. What has improved the new installations? Welded fabrication, of course, plus the use of stainless pipe fittings.

Koppers uses an aligning connector to simplify placement of fittings over the ends of pipe sections. A 3/32-in. stainless electrode and a 55-amp current arc then used to weld all permanent connections. Either pipe or fitting can be expanded into a flange where bolts are used.

Use of the stainless pipe fittings, manufactured by Speedline Div. of Horace T. Potts Co., has eliminated the need for joint preparation, and Koppers quality control personnel have found no instance of wall damage due to welding.

Magnetic? OR Electronic? WELDER CONTROL — WHICH WILL DO YOUR JOB BEST?

Square D makes them all... for simplest or most exacting applications!

Magnetic

for General Purpose Machines

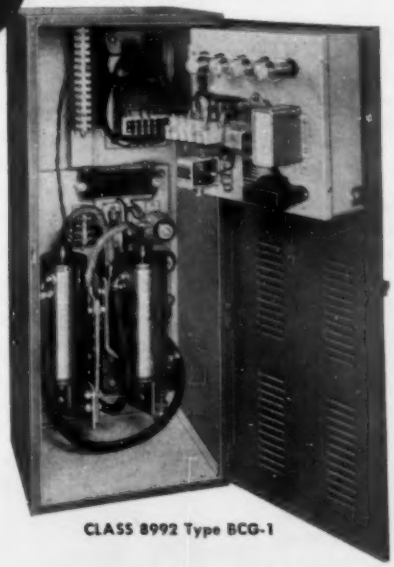
For applications requiring widely varying welding conditions, normal welding speeds and maximum simplicity.

CLASS 8992 Type BBG-1

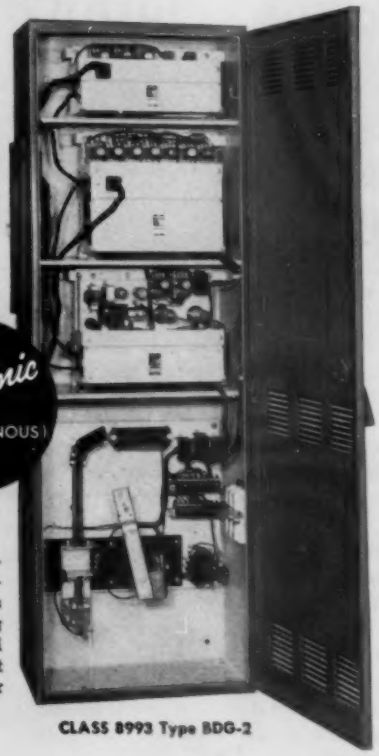
Electronic

for High Speed Welding

For production line (gun or stationary) welders and other applications where high speed, high currents or dual gun control are factors.



CLASS 8992 Type BCG-1



Electronic (SYNCHRONOUS)

for Precision Welding

For welding aluminum, other non-ferrous and ferrous metals requiring precision weld times; stepless heat control; slope or taper control.

CLASS 8993 Type BDG-2

You'll find your nearby **Square D Field Engineer** *a source of sound counsel in selecting the welder control best suited to your application.*

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

THE completed 158-in. long pressure vessel just prior to being shipped to St. Paul. The usual 4 to 5 month fabrication period was cut to less than 30 days.

Orchids to Hahn & Clay for proving ingenuity, cooperation and planning can total a

Pressure vessel fabricated in less than 30 days

By L. F. Megow

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The answer was yes, providing material was available, would fit the facilities and specifications were positive and complete.

The following day an engineer from St. Paul was in Houston going over details. The vessel was to be fairly simple—54-in. ID, 158 in. long with a 900 psi working pressure at a temperature of 650 F, plus one 18-in. manway, six various sized nozzles 2- to 6-in. in diameter, one tangential connection and a set of horizontal supports.

Materials And Design

The material to be used was two 1¼-in. flat T-1 firebox quality plates, 95 by 260 in., with yields of 116,800 and 121,300 psi, tensile strengths of 128,100 and 130,100 psi and elongations of 20 and 19% respectively.

The only difficulty was the plates were in a gondola car somewhere between Pittsburgh and Chicago, destined for a Chicago warehouse.

While waiting for the plates to arrive in Chicago, the design was completed. To meet ASME code conditions it was necessary to use compatible material for all reinforcing pads, manway and nozzle necks. Flanges and covers, however, could be of carbon steel forgings.

Enough 5/16, ⅜, and ⅝ in. T-1 plate was available for the manway and nozzle necks. These were hot formed, re-heat treated, welded to the flanges and x-rayed while waiting for the heads and shells.

Head And Shell Forming

Open head forming capacity was found at the Universal Head Co., Joliet, Ill. Since the plates were headed for Chicago, it was decided to have the shell plates machined and rolled in the Chicago area while the heads were being formed.

While the two head blanks were being cut, shipped to Joliet, heated and formed, three sides of each shell plate were being machined at the Lasker Boiler Works, Chicago. The fourth side was left unmachined, so if the heads did not finish form at exactly 54-in. ID, or be slightly out of round from quenching, they could be machined to suit.

This precaution was not necessary, since both heads were round and within ⅛ in. of the specified diameter after being heated twice to 1,900 F for two forming operations, reheated to 1,650 F, water quenched and then drawn back at about 1,200 F, all in less than ten elapsed hours.

Testing

Test bars were cut from the center of one head at the manway location, machined and pulled, showing a yield of 95,367 psi and a tensile of 117,506 psi. This was slightly lower than the original plate, but well above the minimum T-1 standards. Later a specimen was cut from the head, and when micro-filmed, showed excellent grain structure.

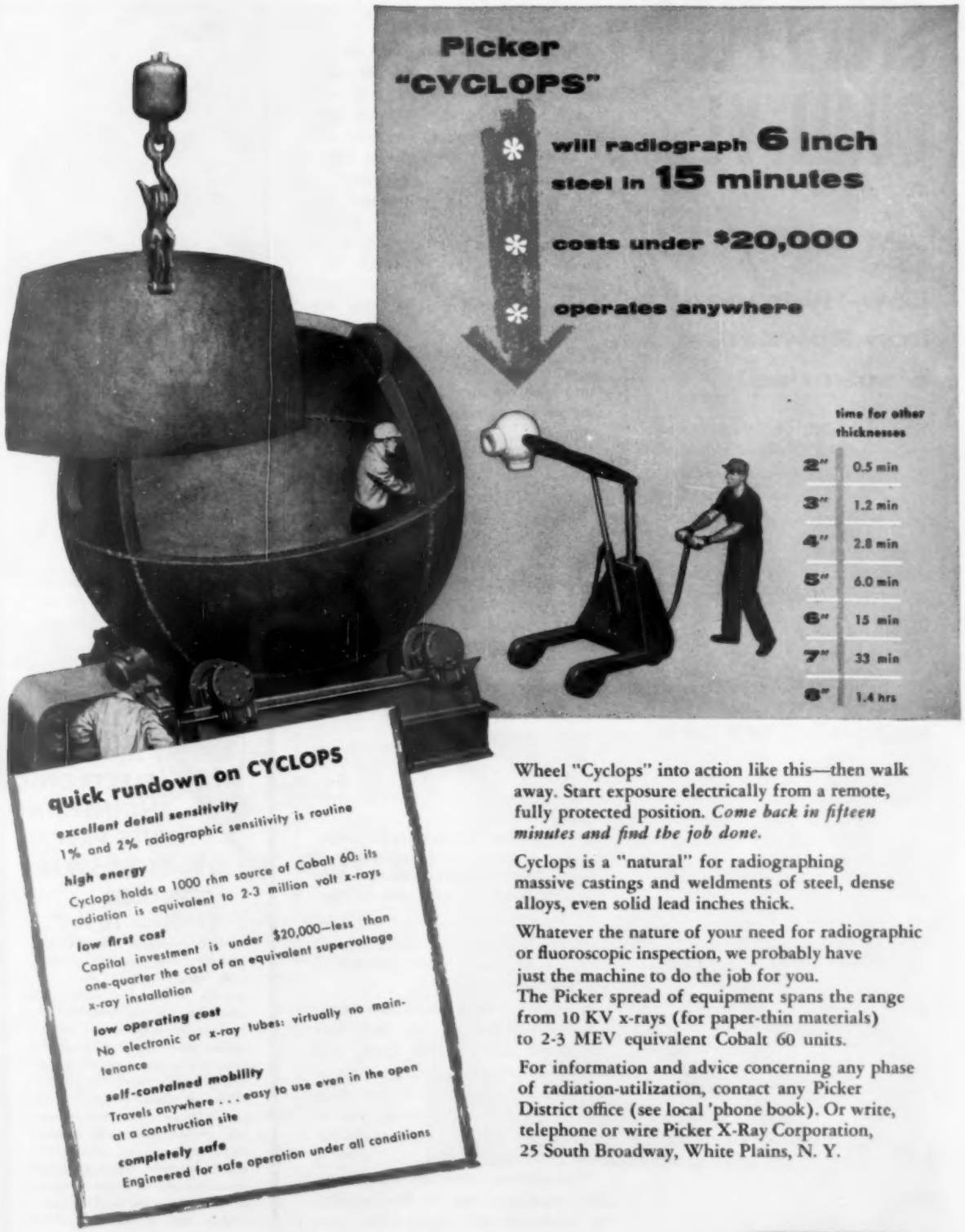
While the heads were being transported from Joliet to Chicago, the fourth side of each of the two plates was machined.

In spite of using all the power from a 250 ton sectional press, attempts to prebend the plate ends cold failed. Ends were then heated to between 1,000 and 1,100 F, carefully controlled by a pyrometer and checked by tempil stick markings. At this temperature the ends were bent to the correct radius. Finish cold rolling required the maximum power of the largest plate roll available.

Welding Processes

Less than 48 hours after head forming started in Joliet, the machined and rolled cans, the two formed heads and remnant plates, to be used for reinforcement collars,

VIEW of one of the two vessel heads just after they were machined for welding.


Picker
"CYCLOPS"
will radiograph 6 inch steel in 15 minutes
costs under $20,000
operates anywhere
time for other thicknesses
2" 0.5 min
3" 1.2 min
4" 2.8 min
5" 6.0 min
6" 15 min
7" 33 min
8" 1.4 hrs
quick rundown on CYCLOPS
excellent detail sensitivity
1% and 2% radiographic sensitivity is routine
high energy
Cyclops holds a 1000 rhm source of Cobalt 60: its radiation is equivalent to 2-3 million volt x-rays
low first cost
Capital investment is under $20,000—less than one-quarter the cost of an equivalent supervoltage x-ray installation
low operating cost
No electronic or x-ray tubes: virtually no maintenance
self-contained mobility
Travels anywhere . . . easy to use even in the open at a construction site
completely safe
Engineered for safe operation under all conditions

Wheel "Cyclops" into action like this—then walk away. Start exposure electrically from a remote, fully protected position. *Come back in fifteen minutes and find the job done.*

Cyclops is a "natural" for radiographing massive castings and weldments of steel, dense alloys, even solid lead inches thick.

Whatever the nature of your need for radiographic or fluoroscopic inspection, we probably have just the machine to do the job for you. The Picker spread of equipment spans the range from 10 KV x-rays (for paper-thin materials) to 2-3 MEV equivalent Cobalt 60 units.

For information and advice concerning any phase of radiation-utilization, contact any Picker District office (see local 'phone book). Or write, telephone or wire Picker X-Ray Corporation, 25 South Broadway, White Plains, N. Y.

if it has to do with radiation it has to do with Picker x-ray

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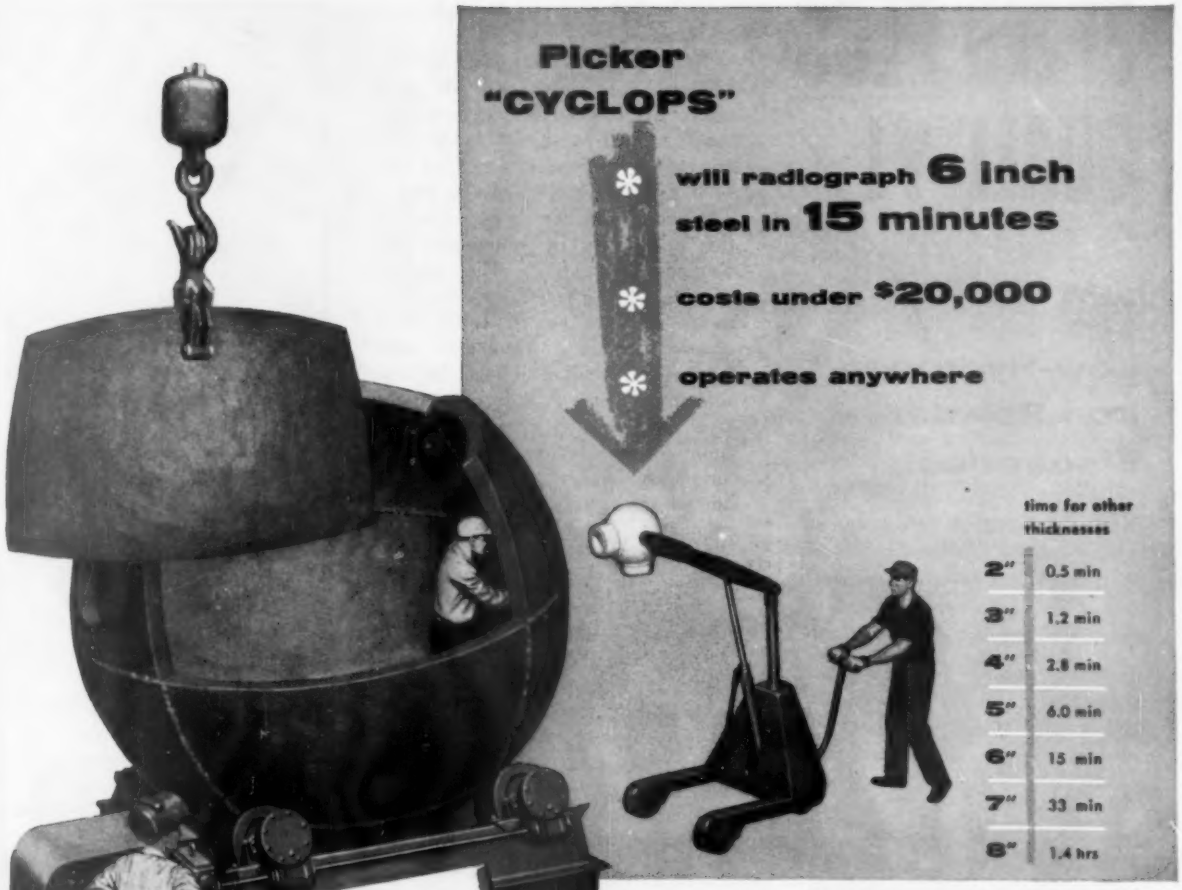

quick rundown on CYCLOPS

excellent detail sensitivity
1% and 2% radiographic sensitivity is routine

high energy
Cyclops holds a 1000 rhm source of Cobalt 60: its radiation is equivalent to 2-3 million volt x-rays

low first cost
Capital investment is under $20,000—less than one-quarter the cost of an equivalent supervoltage x-ray installation

low operating cost
No electronic or x-ray tubes: virtually no maintenance

self-contained mobility
Travels anywhere . . . easy to use even in the open at a construction site

completely safe
Engineered for safe operation under all conditions

Wheel "Cyclops" into action like this—then walk away. Start exposure electrically from a remote, fully protected position. *Come back in fifteen minutes and find the job done.*

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SPEED PLUS QUALITY!

P&H

Low-Hydrogen Iron-Powder Electrodes

Now even "difficult" steels can be welded right the first time—with P&H Iron-Powder Low-Hydrogen Electrodes. They permit faster welding in any position with little or no pre-heat.

Welds are free from cracks and porosity — possess superior X-ray quality and strength. Ideal for welding heavy sections subject to severe shock and abuse. Send for Bulletin R-29. Write Dept. 303B, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

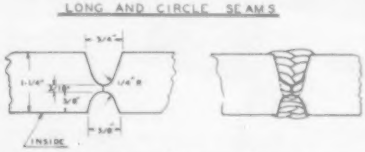
HARNISCHFEGER

were headed south via through truck to Houston.

At the Hahn & Clay plant the vessel was assembled and all main seams handwelded inside and automatic welded outside. Manual welding on the inside seam was done with 5/32-in. E12016 electrodes at 160 to 180 amp, finishing being done on the final pass by automatic submerged-arc welding. The outside seam was first gouged down to sound metal with an arc-air torch, then ground smooth. Automatic submerged-arc welding joined the outside seam using 5/32-in. filler wire at a current of approximately 535 amp. All connections were welded completely by hand, except the outside of the manway pad which was automatically welded to the head.

All main seams were x-rayed, showing only three 1-in. defects, two on the surface and one just below the surface in the inside hand weld. The vessel was then stress relieved at 1,100 F; hydrotested to 1,800 psi.

As an extra precaution, all welds were magnetic-particle tested, inside and out, revealing no defects. As a final check on all weld strengths and plates after stress relieving, a hardness reading was made of each. The portable Brinnell tester used showed a range of 226 to 240 (107,000 to 112,000 psi tensile).



CROSS section diagram shows preparation of long and circle seams before welding as well as the automattic and hand welded seam at the right.

Seven days after shells and heads arrived in Houston, the unit was completed, loaded in a truck, and headed for the refinery, arriving at St. Paul in 48 hours. A few days later it was installed at Great Northern Oil Co. refinery and ready for work.

This ordinary pressure vessel, usually requiring four to five months for materials and fabrication, was completed, delivered, erected and put into service in less than 30 days.

This was the result of precise planning, complete customer cooperation, selected sub-contractors, continuous expediting and experience.

Servospeed
HEART OF AUTOMATION
MODERN ELECTRONIC ENGINEERING GIVES PRECISE MOTOR SPEED CONTROL
1/100 — 10 H. P.
Modern industrial electronic engineering has been coordinated with electric motor design to provide a versatile means for obtaining the full possible advantage of speed control in DC motors while operated from the regular alternating current power line. Grid controlled "Thyratron" tubes are utilized for power controlled stepless variation to supply motor armature power. Patented feedback, or "Servo" circuits provide constant torque capability over wide speed ranges of as high as 60 to 1 in some models and a minimum of 20 to 1 in others.
Servospeed
DIV. of ELECTRO DEVICES, Inc.
4 Godwin Ave., Paterson, N. J
ARmory 4-8989

MWC informs and entertains 225 in Chicago

FRED Plummer, national AWS secretary, waits for badge at registration desk.

To a selected audience of welding engineers, metallurgists and sales personnel, the 4th annual Midwest welding conference once again offered an array of valuable subject material. The two-day conference was co-sponsored by Chicago Section of AWS and Armour Research Foundation of Illinois Institute of Technology on January 29 and 30.

SHARING a joke while waiting for conference to begin are (l. to r.) Dave Warner, Miller Electric Mfg. Co.; Bob Sommerfeld, A. O. Smith Corp.; and Bill Craske, Arcos Corp.

BELOW left: Comparing notes during a coffee break are Burnell Abel (left), Miller Electric Mfg. Co., and Dick Howland of Harnischfeger. Below right: One of 12 MWC speakers, C.B.&I.'s Perry Arnold (left) discusses his speech with H. L. Miller, Republic Steel metallurgist.

NEVER AGAIN! cut - fit - trim - refit - recut - refit

do it once — do it right! with the

H & M SHAPE CUTTER

PAT. NO. 2408517

Accuracy in cutting or beveling saddles, tees, els, or other designs has long been a time-consuming, trial-and-error process in pipe fabricating. No longer, however!

Today, you can produce *precise* cuts and bevels *the first time* — with an H & M Shape Cutting Attachment!

The H & M Shape Cutter is actually steered around the guiding template by exerting the proper spring tension on the sliding torch assembly. The cutting torch is thereby *forced* to reproduce the exact shape desired.

Eliminate those costly "re-cuts" and "re-fits" by equipping your shop or field crew with an H & M Shape Cutter. Then — do it once, and you've done it right!

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PIPE BEVELING MACHINE COMPANY
311 E. Third St. Diamond 3-0241
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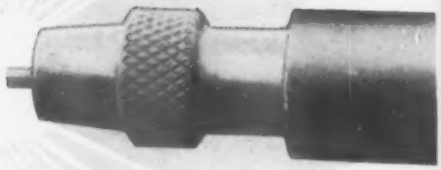
Full details are available immediately. Write or wire.



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Cuts Welding Costs! Speeds Production!

GETS EVERYWHERE!

Hard-to-weld Metals Now Welded Automatically! There is now a portable hand gun—for gas-shielded welding of aluminum, mild and stainless steels, bronze, copper and magnesium! Moreover, this hand gun has its *own self-contained wire supply!*

It is named the WEST-ING-GUN. It works with any standard DC welding machine. It has *averaged* horizontal fillets of 22 inches-per-minute—with 1/16" wire! Throughout *extensive* field tests, this WEST-ING-GUN has *doubled men's daily output!*

OPERATOR FATIGUE "ELIMINATED"! This WEST-ING-GUN "handles" as easily as pointing your finger, to weld in *any* position—regardless of cramped quarters! Its portability between gun and control—between control and power-source—provides complete working freedom and ease—up scaffolding—atop ladders—all around any type of workpiece. This gun weighs only four pounds—including its full, pound reel of wire! Operators working a steady 30% duty cycle, with WEST-ING-GUNS, say they "feel no fatigue at all"!

Welding Remote from Power Source!

20-lb control is readily carried up superstructures! Every shipyard visited, during field-tests, immediately ordered WEST-ING-GUNS!

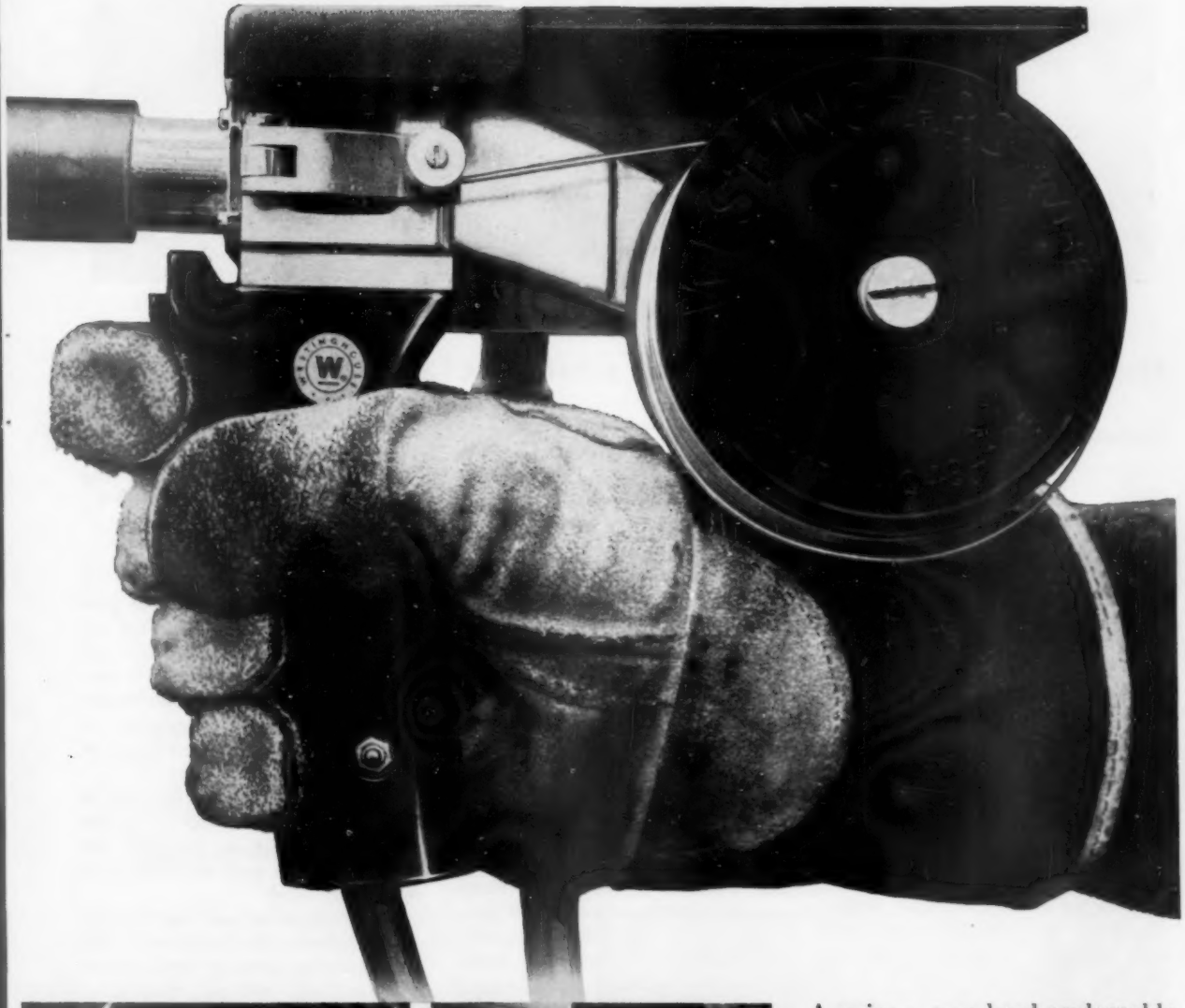
Time Saved in Tight Quarters!

Weld wherever you please! Power and shielding gas are in a single-hose assembly. This permits access to heretofore "impossible" locations!

New Welding Speed on Big Units!

You can take the gun wherever you want to weld! The control stays with the machine! One man can now do the work that used to require two!

Watch Westinghouse for New Developments



Maintenance Welding Simplified!

WEST-ING-GUNS and light-weight control units do the job quickly! Invaluable as a time- and cost-saving production tool!

Aircraft Quality Welds Every Time!

Difficult welds are readily completed with new ease—in production of aircraft equipment—often well back into normally inaccessible areas!

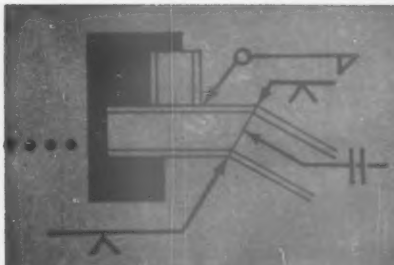
A unique, gear-head replaceable mechanism in the handle drives 1/16" wire up to 350" per minute (finer wire *twice* as fast)! Wire is "inched" at the touch of a button. The short, 6" travel eliminates wire-feeding problems!

There are WEST-ING-GUNS and the controls available—for any DC welders. The compact, rugged control-unit for each model weighs less than 20 pounds. Virtually *every* welding shop has *countless* applications where WEST-ING-GUNS will save *appreciable* amounts of money!

Avail yourself of the opportunity to see what this new production tool can do for you! Contact your nearest franchised Westinghouse Welding Distributor; or write to the Westinghouse Welding Laboratories, Box 2025-A, Buffalo 25, New York.

J-22100

in Welding



the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Oxyacetylene and Tig welding white metal

Question:

I have tried elsewhere but no one seems able to give me information on welding white metal. I recently had my first brush with the material. Can you help me?

Answer:

"White metal" is an all-embracing term as you use it. Actually, white metal is composed of three alloy types: aluminum, magnesium, and zinc (pot metal). But we will confine our discussion to welding the zinc alloys, which comprise approximately 75% of all white metals.

Your first problem, of course, will be to determine the kind of metal you are working with. This can be done with an oxyacetylene flame. Magnesium and aluminum will melt near 1,080 to 1,195 F. Pot metal, on the other hand, melts at 725 F.

Testing Metals

To avoid melting the pot metal—also often called die-castings—brush a soft welding flame over the edge of the casting. If the metal is an aluminum or magnesium alloy, the edge will begin to swell slightly under the flame, although it will not change color.

Die-castings will not change color either, but the surface will begin to crack and globules of metal will push through these cracks.

For a welding process you have a choice between oxyacetylene or Tig (tungsten inert-gas). Most weldors seem to prefer oxyacetylene, although Tig is equally effective.

If you decide to work with oxyacetylene, be sure to use a small welding tip. For example, if casting walls are under ¼ in., a No. 72 drill size tip would be ideal.

Before welding, the metal must be prepared by veeing-out to about 45 deg. If repairing broken castings, file back about ⅛ in. from the crack, always being careful not to destroy the inner edges of the break, which are vital to proper alignment of the broken parts. Any chrome should be ground away.

Because of its fragility, pot metal must be adequately supported. This can be done by molding it in wet asbestos paste. The paste will not only support the casting but also hold heat in it.

You will find that shaping a ⅛-in. bronze welding-rod end into a spatulate form will greatly assist your work. With the paddle shape you can remove scale and rust from the casting, clean a fracture, assist weld fusion, and smooth the metal surface after welding.

However, do *not* use steel for this purpose; it deposits oxide, which will complicate making a clean, fused weld.

Long, Flat Flame

A point always to be borne in mind when welding pot metal is its low melting point. Because of this, the flame should be applied in such a way as to keep the metal as cool as possible.

Gas pressure is one way to attain this. Set oxygen and acetylene regulator pressures at 1 psi each. Turn on and ignite the acetylene. Now turn on enough oxygen to reduce the long acetylene flame to about 4 in.

If the casting is unusually thin, leave the flame predominantly yellow—but short of the point at which the excess acetylene would leave a coating of carbon. Oxygen should be closely controlled so it does not pull down the flame to the white cone characteristic of the neutral and oxidizing flame.

Applying Heat

When the pot metal becomes plastic, turn the flame parallel to the surface and hold the metal at this heat with the side of the flame. Now heat the welding rod (which must be basically of the same composition as the pot metal) to the same temperature.

Base metal and rod both being at the same heat, touch the rod to the break, allowing it to flow into the vee. Repeat this until the opening is thoroughly filled.

Be sure to insert rod *into* the weld to break down skin resistance of the oxide coating which prevents fusion.

Tig Welding

Welding die castings with Tig requires a different approach. Preparations call for veeing-out a 90 to 120-deg included angle, with thicker castings requiring wider angles.

No support or back-up molds are necessary. An 0.04-in. tungsten electrode is used with an argon flow of approximately 5 cu. ft per hour. Amperage should range between 15 and 25, with the lower setting used for thinner sections. Metal over ⅛ in. thick requires the higher amperage.

Hold a short arc and deposit small stringer beads, always moving the torch from side to side in order to melt filler material and fuse it into the sides of the groove.

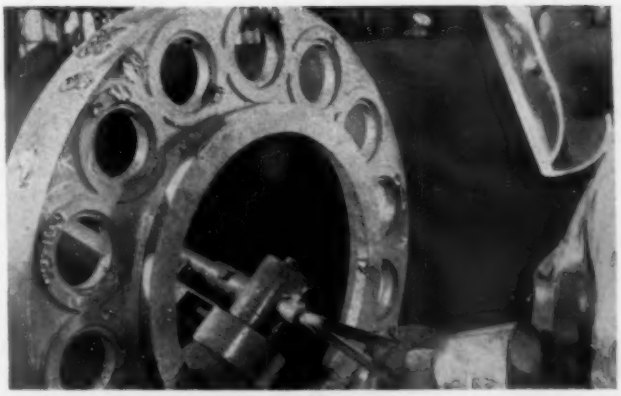
After each pass, wire-brush the weld to remove oxide film.

His new grinding technique cuts costs and back-aches

Problem: At Cooper Alloy Corp., some jobs just couldn't be done with big swing-frame grinders. Yet they were backbreakers when done with portables . . . expensive, too.

Solution: Bay State distributor Jack O'Sullivan, president of Engineered Sales Co., worked with Bay State and Fox Grinders, Inc. . . . devised a baby swing-frame. It used cup and raised hub disc-wheels normally used only on portables and enabled Cooper's operators to grind hard-to-reach surfaces without fatigue . . . and with much more speed and accuracy.

Like Jack O'Sullivan, Bay State representatives often come up with ideas that result in basic operating improvements. Why not call in *your* Bay State man? *Better grinding at lower cost—that is his business.*



New baby swing-frame takes weight load of portable grinder off operator . . . enables him to grind smooth, flat surface without accidental scars and nicks due to fatigue.

BAY STATE WHEELS of PROGRESS

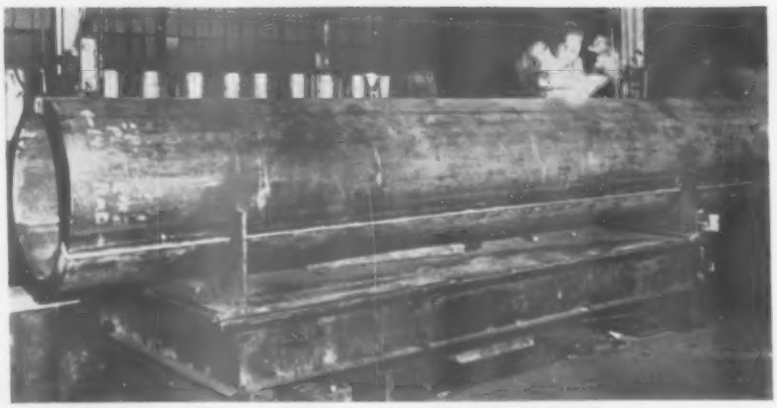
BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh. *Distributors:* All principal cities.

Filler metals for joining

In his 14th article the author discusses nickel and nickel alloy . . .

By Orville T. Barnett*



THREE 2¾-in. thick sections of the largest Monel press roll ever built were joined by 700 lb of Class E3N10 filler metal. The press roll is 20 ft long and weighs 12 tons. (Photos courtesy of International Nickel Co.)

FORWARD LOOKING research has provided a wide choice of nickel and nickel-base alloy filler metals to join the many base metals.

In welding's early days bare rods would be used in any of the welding processes. Now in dealing with nickel metals there are three choices: *(1)* covered (coated) electrodes, *(2)* bare electrodes and rods for inert-gas shielded arc welding and *(3)* bare rods for oxyacetylene welding.

Designations for the nickel and nickel-base metals make use of three possible prefixes. The "E" denoting covered electrodes for manual shielded arc welding is the most familiar. But this does not include bare electrodes for Mig welding. To identify bare wire suitable both as an electrode in Mig welding and as a rod in Tig welding, filler metals now carry a new prefix, "ER." Heat sources may be the arc from Mig, Tig or atomic hydrogen processes.

Electrode Designators

The ERN6X filler metals have a higher titanium content than RN4X filler metals intended for oxyacetylene applications. This titanium deoxidation produces welds without objectionable porosity and the weld metal flows easily under the intense heat sources. With oxyacetylene as the heat source, the weld metal would be unmanageable. The last prefix "R" readily identifies bare wire filler metals intended for oxyacetylene only.

Covered electrodes carry "3" or "4" as an identifying digit before the letter "N." The number 3 designates an electrode to be used for joining nickel-base alloys to themselves, while the 4 signifies electrodes with modified composition to accommodate dilution with steel. These latter electrodes might be used for joining a nickel-base alloy to steel, depositing a nickel-base overlay on steel, welding the clad side of nickel-clad steel, or fixing a nickel-base liner to a steel vessel.

The letter "N" denotes nickel-base filler metals intended for welding of nickel and nickel-base alloys. Unclassified, but available in the welding market, is Inco-Rod "A" for welding of dissimilar metals which may overlap some E4NXX uses. A bare filler wire counterpart for Mig and Tig applications has been developed recently. In an earlier article other nickel-base electrodes for welding of cast iron, ENi, ENiFe, ENiCu A and B, were described.

Welding Processes

Two suffix numbers follow the letter "N." The first of these may be a 4, 5, 6 or 7 to identify the appropriate welding process as follows: 4 as the first suffix digit denotes oxyacetylene welding; 5 as the first suffix denotes submerged-arc welding; 6 denotes Mig, Tig or atomic hydrogen welding; while 7 denotes all the processes for 6 plus submerged-arc welding.

Either 5 or 7 could be used for submerged-arc welding. The specifications provide for a 5 group, but there appears to be no such products available, while the 7 group, which satisfies 5, 6 or 7, is produced.

The last digit or letter indicates the analysis of nickel alloy filler metal.

In the designations E3N10, E4N-10, RN40 and ERN60, "0" signifies nickel-copper or Monel alloys. These materials as base metals are used for general applications of wrought or cast forms for corrosion resistance, toughness and high strength. Manual electrodes for arc welding as well as bare filler metals for oxyacetylene or inert-gas shielded arc welding are all produced.

Number "1" as a last digit in E3N11, E4N11, RN41 and ERN61 points out pure nickel filler metals. Again all welding processes except submerged-arc can be employed. As with Monel, electrodes are manufactured to weld nickel-base metal to itself or to steel. A final digit of "2" in the designations E3N12, E4N12, RN42 and ERN62 classifies Inconel base metals. This group also affords choice of welding processes.

Monel Fillers

In RN43 the number "3" identifies a special nickel-copper-silicon filler metal. It is designed for oxyacetylene welding of lower nickel content Monel (55 to 60% nickel) or regular Monel when flush-free welding is

*Assistant manager, Metals Research Department, Armour Research Foundation of the Illinois Institute of Technology, Chicago.

TABLE I

Nickel and nickel-alloy filler metals

Base Metal	Coated Electrodes		Oxyacetylene Welding		Inert-Gas Arc Welding
	First Choice	Second Choice	Rod	Flux	
SOLID MATERIAL					
Monel	E3N10	E4N10	RN40	3	ERN60
Monel "402" or "403"	E3N10		RN43	None	ERN60
"K" Monel	E3N14	E3N10 a			ERN64
Nickel	E3N11	E4N11	RN41	None	ERN61
Low Carbon Nickel	E3N11	E4N11			ERN61
Inconel	E3N12	Inco-Rod "A"	RN42	2	ERN62
Inconel "X"	E3N19	E3N12 a			ERN69
Inconel "W"	E3N19	E3N12 a			ERN69
Nimonic "75"					ERN6N
CLAD SIDE OF					
Monel Clad Steel	E4N10				
Nickel Clad Steel	E4N11	E4N12			
Low Carbon Nickel Clad Steel	E4N11	E4N12			
Inconel Clad Steel	E4N12				
OVERLAY OF					
Monel on Steel	E4N10				
Monel on Cast Iron	E4N10 b				
"K" Monel on Steel	E3N14 c				
Nickel on Steel	E4N11				
Nickel on Stainless Steel	E4N11				
Nickel on Cast Iron	E4N11	E Ni			
Inconel on Steel	E4N12				
DISSIMILAR METALS					
Monel to Steel	E4N10	Inco-Rod "A"			
Monel to Stainless Steel	Inco-Rod "A"	E4N11			
Monel to 70/30 Copper Nickel	E3N10	E Cu Ni	RN40 or R Cu Ni	3	ERN60 or R Cu Ni or E Cu Ni
Monel to Hastelloy B	E3N10	E4N10			
Nickel to Steel	E4N11	Inco-Rod "A"	RN41	None	ERN62 or ERN61
Nickel to Stainless Steel	Inco-Rod "A"	E4N11	RN42	2	ERN62 or ERN61
Nickel to Monel	E3N10	E3N11	RN40	3	ERN60 or ERN61
Nickel to 70/30 Copper Nickel	E3N10	E Cu Ni	RN40 or R Cu Ni	3	ERN61, ERN60 or R Cu Ni or E Cu Ni
Nickel to Hastelloy B	Inco-Rod "A"	E3N11			
Inconel to Steel	Inco-Rod "A"	E4N11			
Inconel to Stainless Steel	Inco-Rod "A"	E4N11	RN42	2	ERN62
Inconel to Monel	Inco-Rod "A"	E3N11	RN42	2	ERN62
Inconel to Nickel	Inco-Rod "A"	E3N11			
Inconel to 70/30 Copper Nickel	Inco-Rod "A"	E4N11	RN42	2	ERN62 or ERN61
Inconel to Hastelloy B	Inco-Rod "A"	E3N1B			

Fluxes 3 and 2 are Inco fluxes.

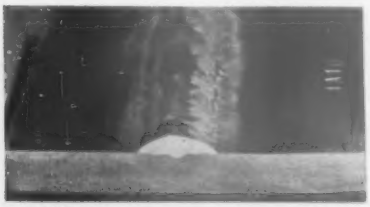
a—Not as age-hardenable as first choice

b—Barrier layer of ENi or ENiFe may be required

c—Barrier layer of E4N10 or E4N11 may be required

sought and when somewhat lower ductility is serviceable. Magnetic permeability is less than with Monel weld deposits.

The nickel-copper-aluminum alloys E3N14 and ERN64 known as "K" Monel are identified by the number "4." Arc welding with coated electrodes or an inert-gas shield are the only acceptable welding processes. Welding is done in the unaged condition. Later the weld deposit may be age hardened by heating to 1,100 F for 16 hours followed by air or furnace cooling. The treated weld deposit may not exceed 85% of the tensile and yield strengths of annealed and age hardened "K" Monel base plate. It is important that the weldment be kept as completely stress-free as possible prior to aging heat treatment to avoid cracking.



GLOBULAR transfer for surfacing minimizes penetration.

An end number of "9" in E3N19 and ERN69 specifies the nickel-chromium-iron-titanium alloy known as Inconel "X." This age-hardened alloy possesses high strength with a low creep rate at temperatures up to 1,500 F.

Like "K" Monel, Inconel "X" may be fabricated by welding manually with bare electrodes, or manually or automatically with inert-gas shielded bare electrodes. The ERN69 filler wire can be used to join Inconel "X" or Inconel "W" base metals.

Age hardening is accomplished by heating to 1,300 F for 16 hours followed by air or furnace cooling. The same limitations to age hardening response described for "K" Monel apply to Inconel "X" as well. Similar precautions to avoid stresses prior to aging are essential for crack-free weldment production.

Final Designators

Hastelloy B alloy (E3N1B, E4N1B and ERN7B) may be welded to itself or used as a cladding for steel plate with the two types of coated stick arc welding electrodes. Bare wire in coils is useful with the inert-gas shielded, atomic hydrogen or submerged-arc welding processes. The oxyacetylene process is not recommended for Hastelloy B welding because of its deterring effect on the alloy's corrosion resistance. Hastelloy C alloy follows the same patterns as Hastelloy B.

In ERN6N the terminal letter "N" is a mnemonic symbol for Nimonic "75." This nickel-chromium-titanium alloy is similar in applications to Inconel with good heat and corrosion resistance up to 2,200 F. Only inert-gas shielded arc or atomic hydrogen welding may be used.

ERN7W is a special filler metal useful for welding some dissimilar metal combinations such as chromium-nickel-iron steels (16% chromium, 25% nickel, 6% molybdenum and balance iron) to the cast cobaltase alloys (26% chromium, 15% nickel, 6% molybdenum and balance cobalt) or other dissimilar metal combinations of this type.

As the classification numbers reveal, this filler metal is suitable for all arc welding processes except coated electrodes and is not to be used with oxyacetylene welding. Another filler metal, Inco-Rod "A", will be described for other dissimilar metal applications.

Metal Contaminants

While it is always good practice to be sure the base metal being welded is clean, this is particularly important with high nickel alloys. These materials, both weld metal and heat-affected base metal, are contaminated easily with lead, bismuth, sulfur, boron, carbon, silicon and certain gases. Small amounts of lead or bismuth or other heavy metals cause hot-cracking during welding, stress-relieving or elevated temperature service.

Sulfur may come from improper cleaning, flux or coating ingredients or from generator acetylene. (Cylinder acetylene may be obtained with a low sulfur content.) This sulfur often combines with the nickel to form a low melting point nickel-nickel sulfide eutectic which, being hot-short, leads to cracked welds.

Boron may come from gas welding fluxes. Reduced by welding gases in oxyacetylene welding, it may become concentrated enough to cause brittle and cracked welds. Carbon, originating with a strongly reducing oxyacetylene flame, may impair corrosion resistance or lead to graphitization embrittlement in service.

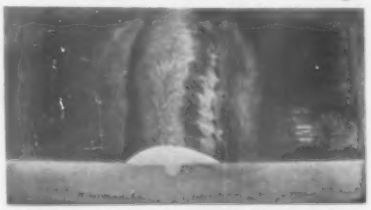
Silicon in Inconel weld metal may be the cause of hot-cracking, particularly if present in larger quantities. The E3N12, E4N12 and ERN62 filler metals all contain columbium. If the columbium-silicon ratio is kept at about 4.5 to 1, the welds are generally quite free of hot-cracking troubles.

An Exception

Because the molten nickel-base alloys have a high solubility for gases such as nitrogen, hydrogen and others, care should be taken to avoid these gas formers in fluxes and, by means of proper drying practices, in coated electrodes. These gases will lead to weld metal porosity if released during solidification.

While the trade name Inco-Rod "A" has been used as an exception to the general rule of using classification numbers only, this exception is necessary until code writing authorities catch up with commercial practice. A comparable bare wire for inert-gas shielded arc welding of dissimilar metals of the type listed in the table is expected to reach the market soon.

As is true of the other nonferrous base metals, nickel and nickel alloys have benefited from the advantages of inert-gas shielded arc welding. A series of special filler metals have been developed to take full advantage of welding ease and metallurgical excellence of deposit associated with Mig and Tig welding. Metal arc welding with coated electrodes has slipped from first to second place in popularity. Oxyacetylene is a poor third.



SPRAY transfer for welding shows penetration.

Used for corrosion resistance and resistance to oxidation, coupled with good mechanical properties at elevated temperatures, the nickel materials are readily welded. Firm adherence to a well planned welding procedure is the best route to a sound weldment.

Like to increase your welding speeds by 50%?

Electrodes coated with

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raise the top limit on welding current - - and increased welding speeds result

Electrodes with Hoeganaes Iron Powder coatings use the excess heat available in the arc to melt the large quantity of powdered metal in the coating.

The conditions of spatter, gouging and undercutting are minimized and additional metal is available for the weld. Naturally, the operation is increased in speed.

If an electrode contains sufficient iron powder in the coating to supply one-third of the deposit from the coating and two-thirds from the core wire, that electrode can deposit 50% faster than the same size conventional electrode.

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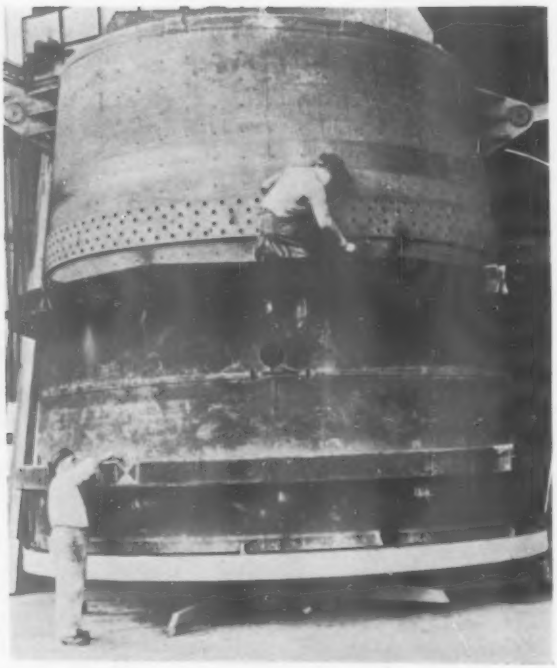
SALES REPRESENTATIVES IN PRINCIPAL CITIES: Birmingham, Chicago, Cincinnati, Cleveland (Fostoria), Edmonton (Alberta, Canada), Los Angeles, Minneapolis, New England (Elmira, N.Y.), Philadelphia (Riverton, N. J.), Pittsburgh, San Francisco, St. Louis

Credit to Welding . . .

Huge steel ladle built in Australia



FIFTY-FOUR TONS of steel in sections up to 9 in. thick comprise a steel ladle recently constructed in Newcastle, New South Wales, Australia.

Said to be the largest of its type ever built, 18 ft high and 17½ ft in diameter, the ladle has molten metal capacity of 293 tons. One of six recently delivered by the manufacturer, Titanic Steel Fabrications Pty. Ltd., it is part of a major expansion in steelmaking facilities.

Weld Problems

Unique problems arose in preheating the heavy sections prior to welding, positioning for assembly and stress relief heat treatment. An idea of the problems can be had from the component part sizes: dished ends are 1½-in. plate; shell strakes, 2½-in. plate; reinforcing bands and trunnion pads, 8¾ in. thick; and the forged trunnion pin, 27 in. in diameter, weighed 2½ tons.

More than three tons of arc welding electrodes, including almost 2½ tons of submerged-arc welding wire, were required for each ladle. Automatic welding was used wherever possible because of its quality and efficiency. An estimated 3,000 manhours was saved on each ladle by using the automatic method.

High Currents

Currents ranging up to 1,050 amp and averaging 800 amp increased manhour production an average of five times that of manual methods. Supplementary semiautomatic welding was more efficient in certain phases because of time lengths or joint accessibility. Manual welding electrodes of the E6020 and E6016 type were used for all downhand welds.

Manufacturing problems, caused by the ladle mass, shape and thickness, brought about unique shop facilities. Titanic had to design special equipment to dish and flange the ladle ends and roll the 2½-in. plate for main shell strakes.

A special 50-ton gantry crane and two smaller overhead travelling cranes handled the ladles. Production sequence was free of all possible handling except when positioning joints for downhand welding.

STIFFENER RINGS are welded to the shells by a worker. Over two tons of welding wire were required for each ladle. BELOW: A close up of the semiautomatic welding of the shell sections. (Photos courtesy of the Lincoln Electric Co., Ltd., Australia.)

To further aid economy, variable-speed positioners were designed to turn the assembly horizontally and vertically, putting welding on a mechanical basis. Weld speeds of 6 to 30 ipm were obtained with the positioners.

Stress relief heat treatment by a specially designed oil-fired furnace brings the ladle to 1,100 F in 28 hours. Heat treatment entailed a 44-hour cycle with cooling period of 24 hours.

"Saved 50% on Crusher Maintenance with WEAR-O-MATIC wire feed unit and wires."

"We've had our Wear-O-Matic Wire Feed Unit for three months and we'll cut hard surfacing maintenance time on our 5360 and 4350 Cedar Rapids crushers by at least 50%. For the first time it looks as though our weldor will be able to do the right kind of a job on these crushers with enough time left over to do an adequate job on the shovels and other equipment."

"In addition to a savings in time, we find that Wear-O-Matic wire deposits wear longer than the deposits of stick electrodes we have used. Also, our weldor likes to work with your machine and Payoffpak wires . . . it's the easiest to set up that he has ever used."

Maintenance Superintendent
Lincoln Stone Inc., Thomasville, Penna.

U. S. Patent applied for.

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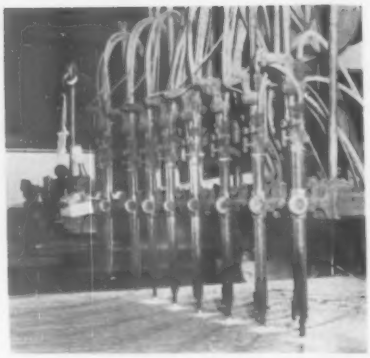

ABOVE: Worker adjusts flame-cutting unit prior to beginning next section's flame-cutting. Note template and part of 184 ft continuous rail. Right: Worker watches as six-torch assembly cuts into 1⅝-in. thick plate with electronic tracer guiding the operating bar.

Flame-cutting line plays marketing role

By A. E. Yoch
Air Reduction Sales Co.
Philadelphia

PROBABLY ONE of the longest flame-cutting lines in modern industry plays a central role in marketing versatility at Colorado Fuel and Iron Corp.'s Claymont Steel Fabrication Div., Claymont, Del.

Steel is made available to customers in various stages, from ingots, plate and prepared parts for fabrication, to assemblies and end products.

A series of four Airco Travographs, mounted on 184 ft of continuous rail, perform multiple-torch operations on cutting tables which accommodate a wide range of plate sizes and thicknesses.

Flame-cutting operations were integrated into the single line by joining 11 sections of 16-ft steel track and one 8-ft section. The flame-cutters travel on two rails between the tracing and cutting tables, permitting easy positioning and repositioning for cutting heavy plate sections with a minimum of material handling.

A typical setup is the six-torch assembly shown in the photographs cutting 1⅝-in. thick flange ring quarter-sections for tank cars. Cutting speed is 9 ipm with an electronic tracer guiding the operating bar.

Among the many products for which Colorado Fuel and Iron Corp. is noted are giant Y sections for underground water aqueducts, huge conical sections, large diameter pipes and steel mill charging boxes as well as all-welded steel plate construction girders.

LARGE electro-magnet lifts scrap left after flame-cutting flange ring quarter sections for tank cars. One of four cutting units is in background.

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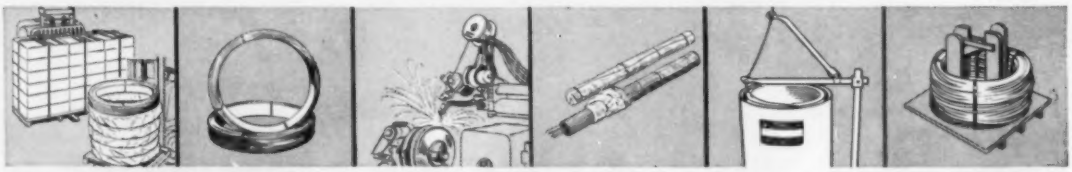
• When you choose PAGE Welding Wire, you are assured of getting the exact wire for your application—and receiving it packaged to provide maximum protection and convenience. PAGE has developed a packaging program to cover practically every requirement in the broad fields of automatic, semi-automatic and manual welding. Coils, reels, bundles, cartons, Leverpaks, Payoffpaks, Payoff-pallets... PAGE has them all! Look to PAGE for the *right* packaging of the *right* wire.



Wrapped Coils—Coils in Cartons | Welding Wire in Coils | Handy Reels | Gas Rod Packing | Payoffpaks and Leverpaks | Payoffpallets

This Chart Shows How PAGE Offers The Exact Packaging You Want

PACKAGING ↓ / PAGE WIRE for →	Gas-shielded consumable electrodes: Automatic Welding	Gas-shielded consumable electrodes: Semi-Automatic Welding	Filler wire for automatic or manual Inert Gas Welding	Submerged Arc Welding	Straight and cut lengths Bare wire: Manual Electric Welding	Straight and cut lengths Bare wire: Oxy-acetylene Welding
25-lb. or 60-lb. coils wrapped in waterproof paper, steel-strapped, single or palletized.	✓	✓	✓	✓		
25-lb. or 60-lb. coils in individual cartons, single or palletized.	✓	✓	✓	✓		
120 or 180 lb. (22″/24″ I.D.) coils, paper-and-burlap wrapped, or in cartons, palletized.	✓			✓		
Special coil sizes (on application).	✓	✓	✓	✓		
25-lb. reels (spools) in carton to fit all standard machines; single or palletized.	✓	✓	✓	✓		
Leverpaks, 15″ dia., 25-lb. coils (12″ I.D.x2½″ wide); Leverpaks, 17″ dia. 50/60-lb. coils (12″ I.D.x4″ wide).	✓	✓	✓	✓		
Payoffpaks: 20″ dia. size holds up to 500 lbs.; 23″ dia. size holds up to 700 lbs.	✓	✓		✓		
Payoffpallets, holding 900-1200 lbs. of wire (¾″ to ⅜″ sizes, incl.) coiled around pedestal on a wooden pallet.				✓		
Paper-and-burlap wrapped bundles, containing 50 lbs. of rods in 36″ lengths.			✓			✓
Fibreboard cartons, containing 10 lbs. of rods in 36″ lengths; single or boxed. 50# and over.			✓			✓
Burlap-wrapped 50-lb. bundles of bare wire electrodes in 14″ and 18″ lengths.			✓		✓	

33 DIFFERENT ANALYSES

PAGE covers the field of applications with *33 different analyses:* heavy automatic submerged arc..light manual submerged..inert gas manual...automatic, tungsten or metal arc, and oxy-acetylene gas welding.

Look to PAGE for your needs for automatic welding wire, gas welding rods, bare electrodes or metal spray wire.

PROMPT DELIVERY FROM LOCAL STOCKS

PAGE welding wire and rods are available from your nearby PAGE Distributor or PAGE warehouse stocks (*see list at right*).

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- **Folder DH-402A** PAGE Submerged Arc and Inert Gas Welding Wire
- **Booklet DH-1277** PAGE Gas Welding Rods
- **Welding Rod Comparison Chart**

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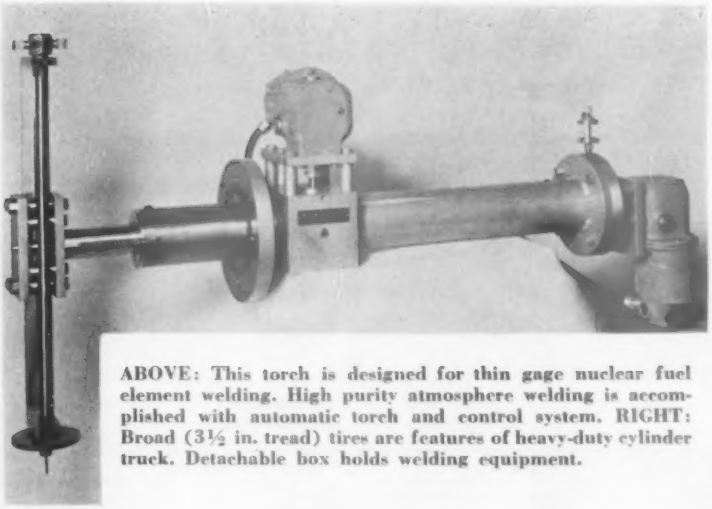
*Indicates PAGE warehouse stocks

new products . . . . USE CARD ON PAGE 97



ABOVE: This torch is designed for thin gage nuclear fuel element welding. High purity atmosphere welding is accomplished with automatic torch and control system. RIGHT: Broad (3½ in. tread) tires are features of heavy-duty cylinder truck. Detachable box holds welding equipment.

Welding torch

AUTOMATIC welding torch and control system is for high purity atmosphere welding. Torch is designed to meet the most critical standards of thin gage nuclear fuel element welding. Easily replaceable torch head is a collet type water-cooled holder, rack and pinion mounted with adjustable cam follower guides. Two standard voltage regulated gear head motors drive the torch head. Specifications: electrode sizes, 0.040 to ¼ in.; maximum current, 600 amp; maximum rate of vertical travel, 60 ipm; maximum rate of horizontal travel, 32 ipm; high frequency arc starting can be used. *Vacuum Specialties Co., Inc.*

Circle No. 1

Tungsten rod

SINTERED tungsten carbide rod for fishing tools consists of particles contained in a nickel-silver matrix, for application to the fishing tool by oxyacetylene torch. Four particle ranges are available, with tungsten carbide content varying from 60 to 75%. Made of tool bit grade, the particles are tinned to assure maximum weldability in application, manufacturer says. *Stoody Co.*

Circle No. 2

Wheel salvager

ALL types of worn grinding wheels can be resized with a new grinding wheel salvaging machine. In about 20 minutes a wheel can be resized and, if necessary, the wheel's bore can be re-established. Wheels from 8 to 42 in. in diameter and up to 14 in. thick can be handled by the new machine.

Driven by V-belts, the machine's 7½-hp motor supplies power. Spindle speed is variable from 125 to 500 rpm. Standard conical type grinding wheel dressers are used, cutting action is confined to crushing the wheel bonding. *Wickes Corp.*

Circle No. 3

Filler

IMPROVED calcium silicate acetylene cylinder filler has increased its porosity to 92%, firm reveals. The filler will be standard in every "Prest-O-Lite" acetylene cylinder. The cylinders now weigh as much as 28.6% less than cylinders with old-style charcoal monolithic filler. Filler is formed inside the cylinder, producing a highly porous (92% void) mass which conforms to the cylinder shape. *Linde Co.*

Circle No. 4

Electrodes

PURE nickel electrode No. 100 has metallic coating which allows welding on finished and polished areas of castings without danger of arcing through the coating, manufacturer says. *Welding Equipment & Supply Co.*

Circle No. 5

Many of these new products can be seen at the American Welding Society's Sixth Annual Welding Show to be held in Kiel Auditorium, St. Louis, April 15 through 17.

Cylinder truck

PUNCTURE-proof semi-pneumatic tires with a broad 3¼ in. tread are features of a new heavy-duty cylinder truck equipped with special wheels 20 in. in diameter. Built of angle iron and 1¼-in. tubing, the truck is designed for contractors, etc. Welding equipment and tools are carried in a detachable box, and an eyelet facilitates lifting the truck with a crane or derrick. *National Welders Supply Co.*

Circle No. 6

Silver flux

DEVELOPED for unusual applications, "No. 601" non-corrosive silver solder flux is a high temperature, 1,800 to 2,000 F, long cycle flux. Works well on stainless steel and for brazing thin to thick sections of metal where rate of heat conductivity differs greatly, manufacturer says. Flux will not disintegrate under high heat. It eliminates flux inclusions and porosity, making clean, nonporous joints having great strength and ductility. Flux residue is removed by flushing with hot water. *Superior Flux and Mfg. Co.*

Circle No. 7

Torch lighter

BATTERY-operated torch light is portable and has magnetic controls for easy placement on any unpainted metal surface. Flint and open flame are eliminated. Priced at $9.95. *Thermacote Co.*

Circle No. 8

Pipe squeezer

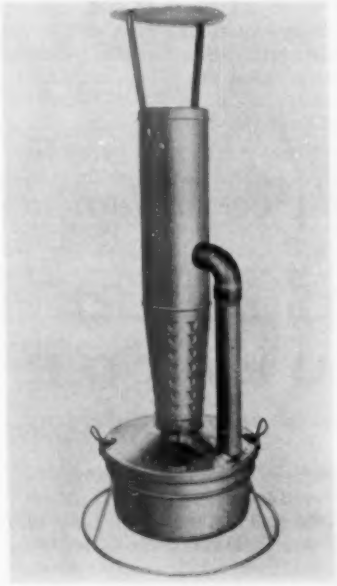
HYDRAULIC tool can be used as a line-up clamp in welding pipe. Light, compact and easy-to-carry, the "Flow-stop pipe squeezer" operates in temperatures from —65 F to 160 F. Two models are available: 5024, designed for cold nominal pipe up to 2½ in. and copper pipe up to 3 in., pressures to 7,500 psi, 40 ton capacity; model 5045 for use on heated nominal steel pipe up to 2 in., and copper pipe up to 2½ in., pressures to 4,000 psi, 15 ton capacity. *Regent Jack Mfg. Co.*

Circle No. 9

Welding stud

NEW type welding stud and ferrule come in range of sizes and shapes. Stud contains no flux; instead it features a projection tip which initiates the arc. Effective shielding of arc is accomplished by the new type ferrule which accompanies every stud, manufacturer reports. *Shielded Stud Welding Co.*

Circle No. 10



Space heater

PORTABLE space heater for permanent or spot heating is for machine shops, warehouses, etc., where there are hard-to-heat areas. Heater produces 70,000 to 140,000 Btu's per hour using ½ to 1 gallon of fuel oil. Its large stack with deflector stands over 5 ft high and throws heat sideways and in all directions. The portable heaters sell for $21, and one 10-gallon filling lasts about 20 hours at normal burning rate, firm reports. *Scheu Products Co.*

Circle No. 11

Switch to Ranite Hardsurfacing Rods...

They're "The Weldor's Rods"

Rated "easiest to use" by a wide margin . . . exceptionally smooth running, with rapid deposition rates . . . no slag to remove from deposits or guess through to determine gauge . . . are easily struck . . . very little splatter . . . over 80% recovery rate.

They're "Job-Graded"

There's a Ranite rod that's exactly right for any hardsurfacing job—regardless of whether the wear condition is caused by shattering impact, severe abrasion, or some combination of impact and abrasion.

They're "Color-Coded"

The colors are keyed to the exclusive Ranite Select-O-Graph Guide so you can pick the right rod for any job with no guesswork.

GET YOUR NEW FREE
Ranite Select-O-Graph Guide, in convenient shirt pocket size; ask your Ranite distributor or write direct TODAY.

Ranite
HARDSURFACING RODS

RANKIN MANUFACTURING CO.
616 S. Marengo Ave.,
P.O. Box 631
Alhambra, Calif.

ANY Pipe Joint or Structural Angle Cut NOW Layed Out in Just MINUTES!

- Marks off easily and accurately any pipe joint.
- Eliminates all figuring of cut backs, and marks all around pipe.
- Saves man-hours, as well as oxygen and acetylene gas.
- Makes it easy to mark off end of lateral pipe.

NO MISTAKES — NO TIME LOSS

—regardless of the type or size of pipe joint to be welded. No more "cut and try" with a **CONTOUR MARKER** — it eliminates the need for calculation, and is available in 2 sizes for marking pipe and structurals of 1½" to 18" in cross section, and from 16" to 48" diameter. Send for complete description.

CONTOUR MARKER CORP.
1843 E. Compton Bl., Compton, Cal.
Also Mfgrs. of Boyce Centering Heads, Radius Markers and Pipe Flange Aligners.

THE CONTOUR MARKER

Arc welder

OF diverter path design, a new industrial a-c transformer-type arc welder provides five steps of coarse adjustment (1-2-3-4-5) with a rheostat for fine adjustment in each range. Control rectifier is standard selenium type—35 volts d-c. No high voltage appears across any control coils.

Model TD-316-S is rated 300 amp at 40 volts a-c, with a welding range of 35 to 375 amp. Model TD-416-S is rated 400 amp at 40 volts a-c with a welding range of 35 to 500 amp. Model TD-516-S is rated 500 amp at 40 volts a-c with welding range of 35 to 625 amp. *Hobart Brothers Co.*
Circle No. 12

Filter

FRESH air, filtered for ventilating areas such as vats, tanks, etc., is available from a portable, self-contained source known as "Filtairvent." Unit employs positive pressure impeller to deliver a rated 560 cfm of air through a 20 ft length of 8 in. diameter synthetic fabric hose. *Dustender Co.*
Circle No. 13

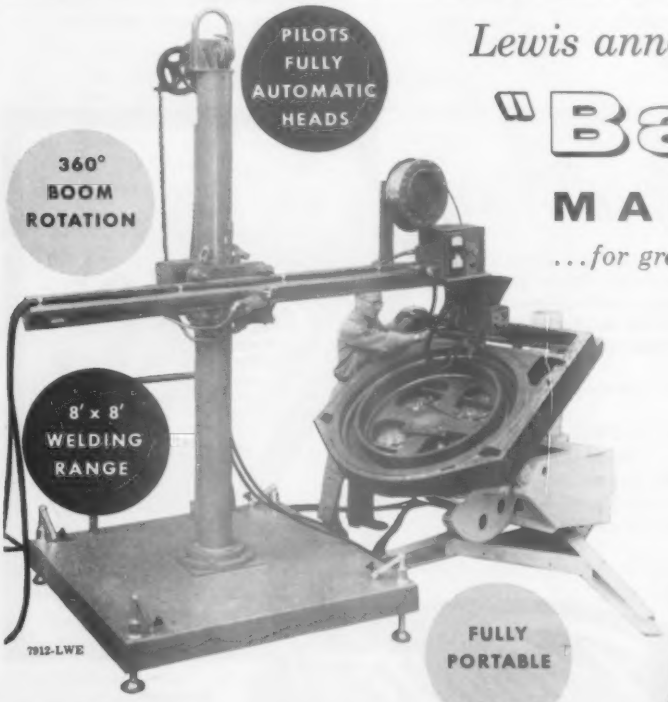
Cutter

OSCILLATING dry-abrasive cutter has a heavy-duty 10 hp, 3,600 rpm motor for spindle speed of 2,450 rpm. Unit handles solid steels up to 4 in. square, 6 in. angles, 8 in. channels and 4 in. OD pipe or tubing at 90 deg to axis. Unit will sever angles, channels, pipes, tubes, etc. *American Chain & Cable Co.*
Circle No. 14

Lewis announces the versatile new

"Bantam" MANIPULATOR

...for greater savings in automatic welding



Fabricators get new versatility for automatic welding operations . . . at remarkably low cost . . . with the LEWIS "Bantam" manipulator. Designed to handle diversified fabrications, short production runs and special jobs, this machine features infinitely variable welding speed . . . extreme accuracy with boom-tip loads up to 250 pounds . . . manual or powered elevation.

FOR DETAILS, SEND COUPON FOR BULLETIN 7703.

THE LEWIS WELDING & ENGINEERING CORP.
111 NORTHFIELD ROAD • BEDFORD, OHIO
Please send new Bulletin 7703 describing LEWIS Automatic Welding Head Manipulators.
NAME.....TITLE.....
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LEWIS — THE LEWIS WELDING & ENGINEERING CORP.
DESIGNERS • ENGINEERS • FABRICATORS • MACHINISTS

Furnace

HEAT TREATING applications needing protective atmosphere at temperatures up to 2,750 F can be done with the large tube (4 in. ID) of a new high-temperature atmosphere furnace. Supplied with a metal-ceramic tube assembly, the type GT-34 furnace is complete with blast gates and automatic flame curtains at both ends. Water-jacketed cooling chamber enables cooling work while under protective atmosphere. Furnace is self-contained, with all electrical components in bottom portion and is prewired and piped. *Lindberg Engineering Co.*

Circle No. 15

Brazing rod

LOW-fuming bronze brazing rod is available in five diameters ($\frac{1}{16}$ to $\frac{1}{4}$), and is recommended for general purpose, all-around welding and brazing. Low melting point (1,575 F) allows free flow and produces a tough, yet ductile, weld deposit of high tensile strength. Ambraze #411 has a composition of R Cu Zn-C. *American Brazing Alloys Co.*

Circle No. 16

Ram bender

HYDRAULIC ram bender can be moved to the job. It will bend $\frac{3}{4}$ in. through 6 in. pipe, I-beams, channels or angles. Single hydraulic valve brings the ram cylinder in and out of bending position. Pipe is placed in support blocks, and dies are shaped to fit part to be bent. Ram moves forward pushing against part in the die blocks. Machine is all welded. *Wallace Supplies Mfg. Co.*

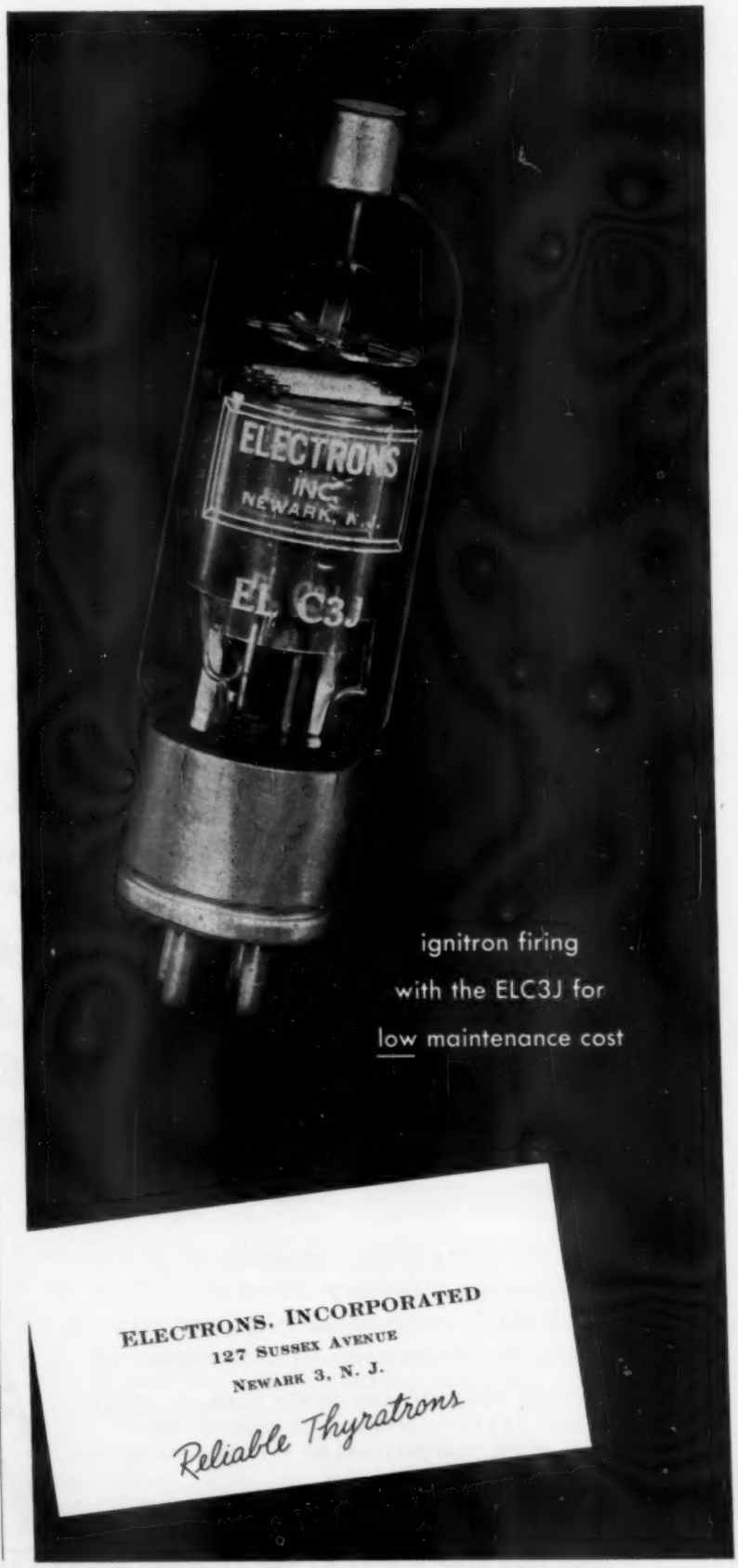
Circle No. 32

Weld system

PACKAGED controlled atmosphere welding systems have stainless steel interior, firm reports. Tank volume is 40 cu ft, inside clear diameter is 30 in. and inside clear length, 90 in. Floor space necessary for the 6,500 lb weld system is 150 in. by 120 in. Diameter glove ports are 8 in. and overall height of unit is 48 in. Ultimate vacuum in tank is 5 by 10^{-4} mm hg.

Features of the system include: post mounted machine torch, manual torch, wire feed mechanism, welding power supply unit, argon purification unit, cold trap, leveling screws, tempered glass viewing ports, lighting ports, hinged flange covers, inert gas manifolds, bellows-type gloves, dynamic braking and motor control. *L&B Welding Equipment, Inc.*

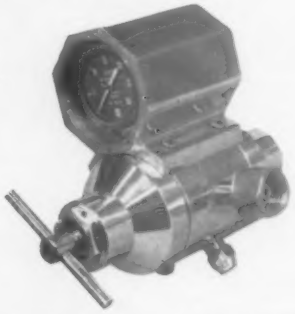
Circle No. 17



PATENTED

OXO

SAFETY REGULATORS



AMERICA'S LEADING INDUSTRIES ARE BUYING THESE REGULATORS

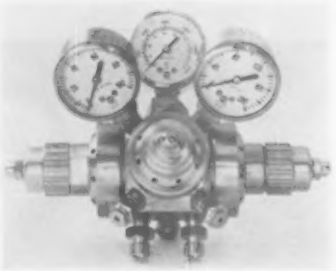
FOR ONE REASON . . .

They are the Best!

Regulators for Every Need

OXO EQUIPMENT CO.

CEDAR and OAK STREETS
NEW LENOX, ILLINOIS

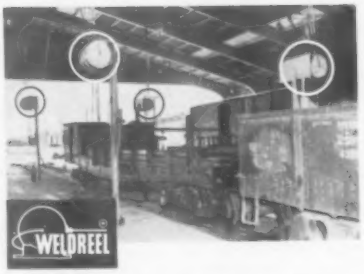


Regulator

NEW and different is a high-pressure gas regulator designed for use on a single cylinder or pipeline outlet when two different delivery pressures are desirable. Unit has one high-pressure stage and two separately adjustable (or preset) low-pressure stages, each with individual safety devices, gage and outlets. A regulator of similar design but with one outlet is available for triple pressure reduction where great pressure accuracy is essential and where refrigeration must be kept to a minimum. *National Welding Equipment Co.*

Circle No. 18

Many of these new products can be seen at the American Welding Society's Sixth Annual Welding Show to be held in Kiel Auditorium, St. Louis, April 15 through 17.



Welding Hose and Cable Reels

SOUTHERN RAILWAY SYSTEM keeps unused welding hose off the floor in their repair facilities at Norris Yard, Birmingham, Alabama, with WELDREEL hose reels.

The banks of WELDREEL units sharply reduce hose replacement—keep working areas clear of unused hose—increase plant safety.

When needed, hose is paid out freely from the WELDREEL reels and locks automatically at length desired. To retract hose, only a slight tug is required to release locking pawls, permitting the powerful springs to rewind hose.

WRITE:

UNITED SPECIALTIES, INC.
P. O. BOX 698 EL DORADO, ARKANSAS

Tempilstik°

FOR ALL HEAT-DEPENDENT OPERATIONS

looks like a crayon... marks like a crayon... tells temperatures like a precision instrument!

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000° F.

TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures — plus or minus 1%.

ALSO AVAILABLE IN LIQUID AND PELLET FORM . . . WRITE "WELDING SALES" DEPT. FOR SAMPLE TEMPIL° PELLETS . . . STATE TEMPERATURES OF INTEREST—PLEASE!

Available in these Temperatures (F.)

113	375	1000
125	388	1050
138	400	1100
150	413	1150
163	425	1200
175	438	1250
188	450	1300
200	463	1350
213	475	1400
225	488	1450
238	500	1500
250	525	1550
263	550	1600
275	600	1650
288	650	1700
300	700	1750
313	750	1800
325	800	1850
338	850	1900
350	900	1950
363	950	2000

Tempil° CORPORATION 132 WEST 22ND STREET, NEW YORK 11, N. Y.

VISIT OUR BOOTH #207 AT THE ST. LOUIS WELDING SHOW, APRIL 15-17, 1958

Cable reels

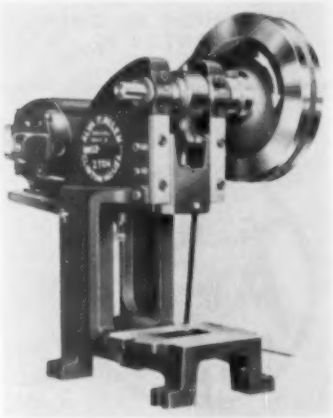
DESIGNED to hold 50 ft of half in. ID hose, model A-2 welding hose and cable reel may be used for handling air, gases or liquids. A spring powered automatic retracting mechanism and automatic pawl lock device permit the hose to be drawn out and locked. Of two other models of dual hose reels one has a capacity of 50 ft, the other, 150 ft and an electric cable reel with 100-ft cable capacity. The self-retracting reels were developed to keep unused welding hose and cable off the floor. *United Specialties Inc.*

Circle No. 19

Resin

EPOXY-resin is used in automatic or production joining of dissimilar metals and non-metallics. Called "Epoxweld 100," it bridges the gap between expensive metallic solders and slow-to-handle two-component epoxy adhesives, manufacturer says. *Duramic Products Div. Technion Design & Mfg. Co., Inc.*

Circle No. 20

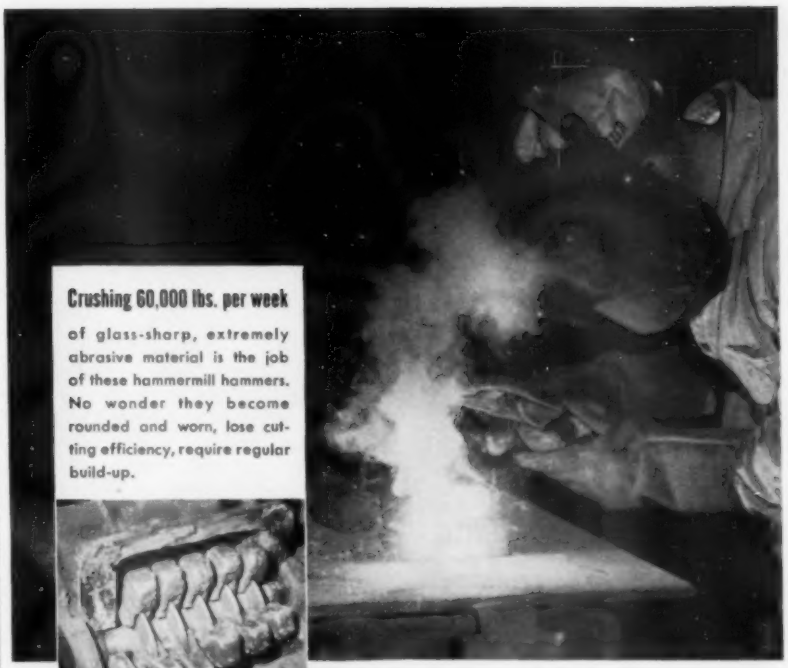


Punch press

POWER bench type punch press model BHS-2 can be used for any standard punching operation in various materials within rated capacity. It has a shut height of 7 in. Crankshafts are special carbon, high manganese steel, ideal for press shafting and resistant to load and shock, manufacturer says. Clutch is single pin, positive, non-repeat or repeat action design. Flat gib allows for take up of wear.

Standard stroke is ¾ in., with ¼ in. to 1½ in. strokes available. Flywheel for V-belt drive has recommended speed of 300 rpm and requires only ⅓ hp motor. Press weight, less motor, is 118 lb. *Alva Allen Industries.*

Circle No. 21


Crushing 60,000 lbs. per week
of glass-sharp, extremely abrasive material is the job of these hammermill hammers. No wonder they become rounded and worn, lose cutting efficiency, require regular build-up.

HARDFACING WITH AMSCO 20

doubles service life . . . cuts electrode costs

Welding Flux Processing, Chicago Heights, Illinois, know a good thing when they see one. That's why they've switched *exclusively* to Amsco 20 electrodes for hardfacing of these hammers. They're saving three ways:

1. Service life of the built-up hammers and the mill housing itself has been doubled, because of Amsco 20's high abrasion resistance.
2. Amsco 20 electrodes cost about 40% less than the type previously used.
3. Welding speed is stepped up. Amsco 20, an iron powder "contact" electrode, is easy to handle and gives a high deposition rate.

In this and many other severely abrasive applications, Amsco 20 has *proved* its ability to provide superior wear resistance at low cost. Available from stock in 3/16" diameter, to handle hardfacing jobs of almost any size.

Call your nearby Amsco Welding Distributor now, for a demonstration of Amsco 20. Or write direct for technical data to: Amsco Welding Department, Chicago Heights, Illinois.

AMERICAN Brake Shoe COMPANY

AMSCO®

American Manganese Steel Division · Chicago Heights, Ill.

OTHER PLANTS IN: DENVER LOS ANGELES, NEW CASTLE, DEL., OAKLAND, CAL., ST. LOUIS, JOLIETTE, QUEBEC

For PROTECTION you NEED with the COMFORT you WANT

Flood Always FINEST QUALITY FAIRLY PRICED

FIBER GLASS HELMET

Strong, one-piece molded shell. Lightweight. Non-warping. Heat and moisture resistant. Easy to clean and sterilize. Comes with Flood No. 14 fiber or No. P-14 all plastic ratchet-type head gear.

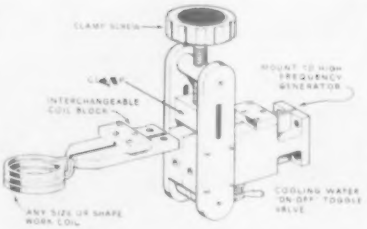
FACE SHIELD

Excellent protection for spot welding, grinding, buffing, acid pouring. Fiber forehead shield. Contour headgear. Easy, window replacement without tools.

Manufacturers of Welding and Industrial Safety Equipment, Including Flood's 1000-Hour Cover Lenses.

At Your Distributor or Write

FLOOD SAFETY PRODUCTS CO.
3035 West Lake Street, Chicago 12, Illinois


CLAMP SCREW
MOUNT TO HIGH FREQUENCY GENERATOR
INTERCHANGEABLE COIL BLOCK
COOLING WATER ON-OFF TOGGLE VALVE
ANY SIZE OR SHAPE WORK COIL

Terminal assembly

USERS of high-frequency induction heaters can get a "Re-coil," which standardizes and simplifies the interchange of work coils, manufacturer says. The product, a terminal assembly, is available in models to fit any induction heater. It remains in a fixed position and contains all operations and fixtures. A variety of work coils may be stockpiled for a variety of jobs. *L. C. Miller Co.*

Circle No. 22

Enlarging paper

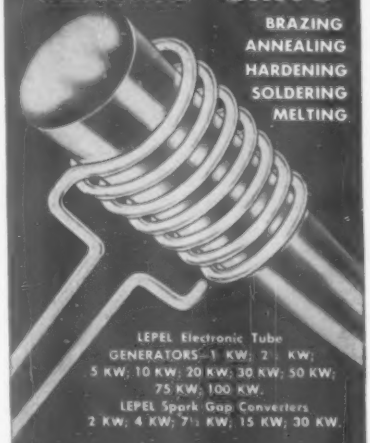
PANCHROMATIC enlarging paper enables industrial photographers to produce black and white prints from color negatives. From an original color negative, black-and-white prints, positive color prints, Dye transfer prints and color transparencies may be made. *Eastman Kodak Co.*

Circle No. 23

Lepel

HIGH FREQUENCY *Induction* HEATING UNITS

BRAZING
ANNEALING
HARDENING
SOLDERING
MELTING



LEPEL Electronic Tube GENERATORS—1 KW; 2 KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.

LEPEL Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

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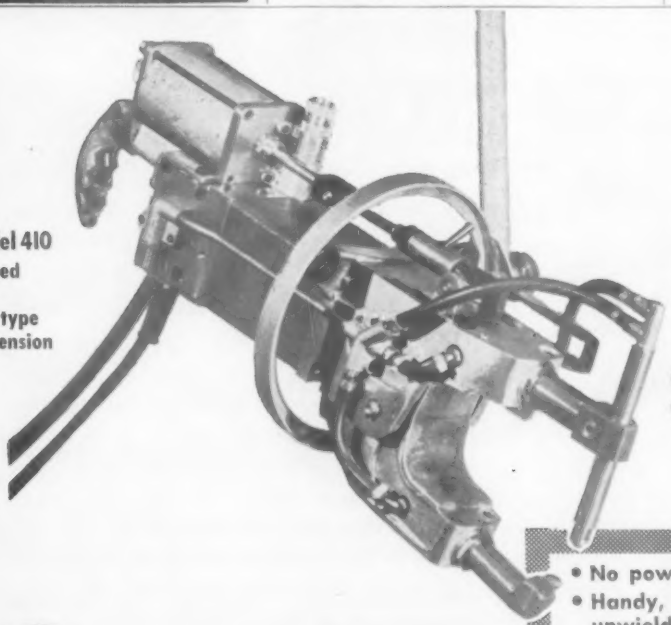
NEW
ARO Model 410
Air operated gun with "Ski-lift" type gyro suspension



ARO

Portable
SPOT WELDERS

- No power loss. Transformer built-in
- Handy, maneuverable—no heavy, unwieldly cables
- Usually costs about half as much as gun-plus-transformer
- Works on existing power lines
- Automatic timing

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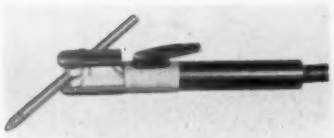
Dealer Inquiries Invited
See us Booth 603, Welding Show, St. Louis

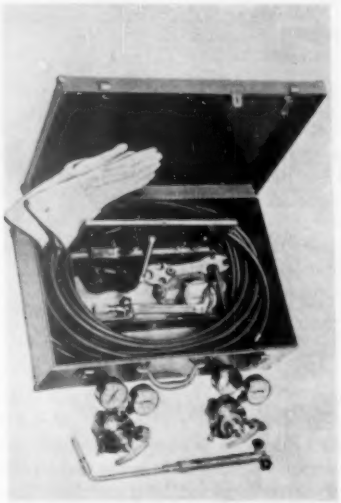


Metal removers

Two new heavy-duty model torches for metal removal can be used wherever intricate contouring (model G-55) or large volume (model M-6) metal removal is required. Model G-55 has air jets on both sides of the electrode for increased maneuverability. It is for heavy-duty service, using ½ and ⅝ in. electrodes only. Heads are insulated with silicone glass laminate and the air supply can be controlled by rotating the heads.

Model M-6 for heavy-duty foundry-type applications, is built basically for ¾ in. electrodes, but is available in ½ and ⅝ in. sizes. Electrode angle is permanently fixed. Heat shield protects the operator's hand, and air control is push-button. *Arc-air Co.*

Circle No. 24



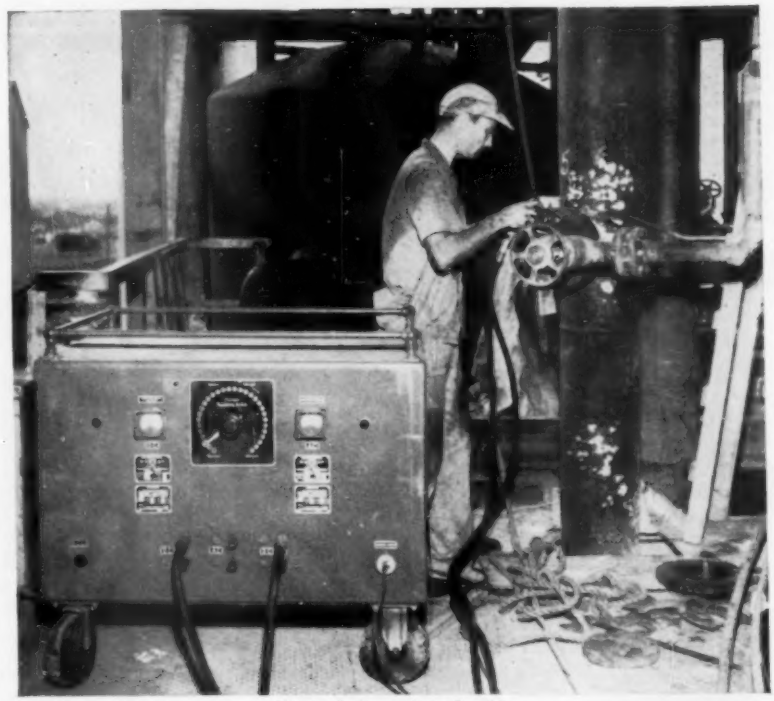
Welding chest

ALL-STEEL chest protects welding equipment in the shop, on the truck and on the job. With reinforced corners, heavy latches, lock and carrying handle, the chest measures 8½ in. by 16½ in. by 24½ in. It holds over 100 ft of hose, oxygen and acetylene regulators, and cutting and welding torches.

A smaller chest built into the center may be opened without removing larger equipment. It holds goggles, lighter, extra tips, chalk, etc. The box lid is cut out to hold regulators. Shipping weight of the chest is 20 lb. *Atlas Welding Accessories, Inc.*

Circle No. 25

Fast • Positive • Low-Cost Inspection of your critical WELDS



Magnaglo inspection of welds

Call **MAGNAFLUX**
NATION-WIDE
COMMERCIAL
INSPECTION SERVICE

AVAILABLE ANYWHERE • ANYTIME

To help you get fast, positive and low-cost inspection of your *critical* welds, *Magnaflux Corporation* has a nation-wide *Commercial Inspection Service* on call when and where *you* want it—in the field or at your plant.

Magnaflux Commercial Inspectors know welding . . . and are *factory trained* in working with all Magnaflux testing methods. They know that it is just as important to recognize *good* welds as it is to find defective ones. Their job is to assure you consistent weld quality, as well as to help you cut your welding costs . . . and build welding business and acceptance through good welds!

When welds are critical, it's good business to have them inspected the *Magnaflux* way. Welds—pressure vessels, heavy machinery, piping and all kinds of heavy equipment—may require precision inspection yet must be done on location. That is where the *Magnaflux Field Inspector* and his mobile test equipment of many types are most valuable. He arrives on *your* schedule fully equipped to perform complete inspections. He not only tells you *what* and *where*, but *how* defects occur. Then, through better job control and working techniques, you'll get more good welds, fewer rejects and less rework.

Small parts weldments can be inspected in the nearby Magnaflux Commercial Inspection Plant. The same fast, positive, low-cost service prevails. Get the nearest telephone number from the list below.

With *Magnaflux Commercial Inspection Service* you get the benefit of a nation-wide standard of inspection . . . by Magnaflux-trained experts using genuine Magnaflux Test Systems: Magnaflux-Magnaglo, Zyglo, Sonizon ultrasonic testing and others.

Write for full details now—
OR CALL ANY OF THE COMMERCIAL INSPECTION BRANCHES SHOWN BELOW.

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Newark 4, N. J. HUmbolt 3-1235	Pittsburgh 36 TUxedo 2-3448	Indianapolis 18 LIberty 7-1303	Houston 21 WAlnut 3-9169
Hartford, Conn. BUtler 9-2737	Cleveland 15 HEnderson 2-0727	Los Angeles 22 RAymond 3-8961	Chicago 39 EVergiade 4-1561
Bridgeport, Conn. EDison 6-2113	Cincinnati 23 MUlberry 1-6436	Van Nuys, Cal. STate 5-8640	Oakland 8 OLympic 8-0201

Typical Sonoweld applications, left to right: insulated copper wire to insulated copper wire, without stripping; aluminum foil to aluminum condenser can; aluminum foil conductor to stranded copper wire.

Ultrasonic Welding* without Fusion

SONOWELD®

This revolutionary new metal-joining technique uses high-frequency sonic energy to effect a solid-state metallurgical bond between similar or dissimilar metals without fusion and without formation of intermetallic compounds.

SONOWELD makes possible the welding of metals and shapes heretofore impossible to weld. Applicable to aluminum, copper, brass, zirconium, platinum, titanium, magnesium, carbon or stainless steel, gold, molybdenum, nickel, inconel, germanium, silicon, etc. Even the so-called exotic metals, such as tantalum, palladium, niobium, used in atomic energy applications, can be ultrasonically welded with SONOWELD.

With SONOWELD there is no spark or sputter to contaminate surrounding areas. Welding is accomplished at relatively low temperatures, with low clamping force and negligible external deformation. Joints are excellent.

Let us tell you more about SONOWELD — and how it may help you to better quality. Write us about your specific welding problems or application.

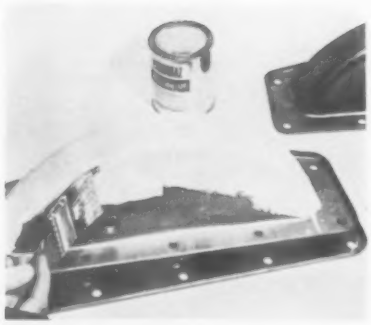
SONOBOND CORPORATION

A SUBSIDIARY OF AEROPROJECTS, INCORPORATED, WEST CHESTER, PA.

Manufacturers of Ultrasonic Metal-Joining Equipment

SONOWELD® • SONOBRAZE® • SONOSOLDER

**Ultrasonic Welding, originated and developed by Aeroprojects, Inc.*



Parting compound

NEW "Nicrobraz" material acts as parting compound to prevent brazing of adjoining surfaces during furnace brazing operations. Named "White stop-off," the new material is in powder form. It is mixed with a volatile plastic for application. The material lends flexibility to furnace brazing—since it is sometimes important that faces of mating components be left free of one another. The material prevents brazing or fusion of any surfaces. Applied by brushing, dipping or spraying. Residue is removed by air-blasting or brushes. *Wall Colmonoy Corp.*

Circle No. 26

Metal marker

BALL point marker has special, fast-drying, opaque, heat-resistant ink that makes lasting marks on metal, wood, plastic and glass. It can be obtained with green, yellow, blue, orange, black, red, brown or white ink that won't chip, peel, fade or rub off, maker says. Sizes allow marks 3/16 in., ⅛ in. or 5/64 in. thick. *John P. Nissen, Jr., Co.*

Circle No. 27

Memory meter

WHEN readings must be known, but cannot be noted at once, a memory meter records for later referral. Unit is a sensitive panel meter and readings may be taken at any point on the meter scale. *Assembly Products, Inc.*

Circle No. 28

Welding alloys

TWO new welding materials scheduled for unveiling at the April AWS show are an inert-gas welding wire and a hardfacing rod. The "Inco-Weld 'A' Wire" is for use on dissimilar alloy combinations, the hardfacing rod has been developed for hardfacing overlays on the low-alloy steels and cast irons where severe abrasive conditions are present. *International Nickel Co., Inc.*

Circle No. 29

Cut marker

CONTOUR scriber marks cut lines for sheet metal, plastics, etc. With scriber, obstructions and cutting problems such as pipes, frames, etc. are marked on the metal to be cut. Retails for 98 cents. *Charles Machine Co.*

Circle No. 30

Tester

HAND-operated tester, "Model CT-134," is for low capacity compression testing. Outstanding features are: load measuring system entirely separated from the load applying system and completely independent of weight of any work put into the tester; system can be calibrated with a proving ring to insure accuracy; unit easily set-up.

Operated by turning a knurled knob at the bottom, the tester has a capacity load of 300 lb, occupies a bench space of 11 in. by 6 in., has overall height of 26 in. and weighs about 40 lb. Vertical opening is adjustable from 4 to 5½ in. Tester can be provided with other dimensions and load capacities. *Steel City Testing Machines, Inc.*

Circle No. 31

Many of these new products can be seen at the American Welding Society's Sixth Annual Welding Show to be held in Kiel Auditorium, St. Louis, April 15 through 17.

GB 88 FLUX.. *available in 3 oz., ½ lb., 1 lb., 5 lb. jars and 25 lb. drums to suit your needs*

Use GB 88 Flux, the flux of proven dependability and note the improvement in the quality of your Silver Brazing. GB 88 is fully active to 1650°F.

Low glare and low fuming characteristics insure operator comfort and quality results. It is stable in use as well as in storage and was developed for Silver Brazing of STEEL, BRASS, COPPER, STAINLESS STEEL, MONEL, NICKEL, INCONEL, CHROME ALLOYS, SILVER and GOLD.

For best results team up GB 88 Flux with GB Silver Brazing Alloy in the form or size you require: random coils (all diameters), strip, straight lengths, pre-formed rings and special shapes. Prompt service on all inquiries.

90th ANNIVERSARY

Goldsmith Bros.
SMELTING & REFINING CO.

111 N. Wabash Ave., Chicago 2, Ill. • 74 W. 46th St., New York 36, N.Y.
OAKLAND

Mail Coupon for your FREE copy of the GB Data Book— complete information on low temperature Silver Brazing

PLEASE SEND GB Data Book without obligation.

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Address_____

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Hackney MILWAUKEE

lightweight cold drawn cylinders for oxygen and other high pressure gases

Hackney gives you everything you want in high pressure gas cylinders—light weight, safety, minimum maintenance, long life—because the *Hackney* cold drawn process eliminates excess material and results in lighter weight, ruggedly built cylinders.

HACKNEY FEATURES INCLUDE:

- maximum strength without needless weight
- light weight—easier to handle
- uniform sidewall thickness, weight—top to bottom, side to side
- uniform cylinder capacity—simplifies filling
- smooth surfaces—free from crevices, ridges
- exceeding all ICC requirements for cylinders
- shapes and sizes for all service requirements—from small medicals to 220's and 250's (cu. ft.) for oxygen, hydrogen, nitrogen, helium, argon and carbon dioxide

WHEN YOU BUY HACKNEY CYLINDERS, YOU:

- save money on shipping costs every time you ship cylinders
- reduce handling costs—minimum manpower needed
- cut maintenance costs—smooth surfaces easily cleaned and painted
- can have personal markings on cylinder and neck ring

for complete details, mail the coupon!

Pressed Steel Tank Company
1456 S. 66th St.
Milwaukee 14, Wis.

Gentlemen: We are interested in detailed facts and prices of Hackney high pressure gas cylinders in (sizes).....; in the quantities 1 to 24 ....., 25 to 99....., 100 to 499....., 500 to 999....., 1000 or more.....

Firm name.....

Your name.....

Address.....

City.....*State*.....

Pressed Steel Tank Company Hackney

Manufacturer of Hackney Products since 1902

1456 South 66th Street, Milwaukee 14, Wis.

Branches in principal cities

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

NEWS . . . . . *from page 8*

Montana. Revenues, too, increase along with the payloads—at the rate of 15%, Kaiser Aluminum & Chemical Corp., reports. Western Oil Tool & Mfg. Co., Inc., of Casper, Wyo., builds the trucks.

The first truck, a 30-ft rig with a rated load capacity of 55,000 lb, was fabricated from two high-strength, weldable aluminum alloys, 5083 and 5086. In January, 1957, the John Dalgarno Transportation Co. of Casper put the trailer in service. An empty steel unit weighed 28,500 lb, while the aluminum unit weighed 24,100 lb.

The main structural member is a 24-in. deep box-type girder running the length of the trailer. Two main beam webs 38 in. apart carry the center plate, outer floor plates, outriggers, mounting pads and cross members. In the forward transition section, depth is decreased to 6¾ in. to provide clearance for the fifth wheel assembly, and a double-webbed box girder construction is used so stresses are kept within allowable limits and the integral rigidity of the whole structure is maintained.

Precision parts

NEW powder metallurgy process developed by P. R. Mallory & Co., Inc., cuts time and cost of production of precision metal parts, firm says. Dense, structural parts are made from inexpensive raw materials. Here, flanged bushings made of powdered iron alloys are unloaded from a sintering furnace in the company's "Steelmet" pilot plant in Indianapolis.

Crucible adds to foreign service

An export sales and service company to serve overseas markets with specialty steels has been established by Crucible Steel Co. of America, Pittsburgh. The new company, Crucible Steel International, S.A., will headquarter in Nassau, Bahamas, B.W.I.

"New look" in smokestacks

Unique fiber glass smokestacks which utilize glass-fused-to-metal structure are being marketed by A. O. Smith Corp., Milwaukee. The stacks are designed to give 300 to 500% longer protection against corrosion, and they last three to five times longer than the conventional steel stack, the firm specifies.

A basic stack section is made up of ¼ in. steel, ASTMA285, Grade A specification or equivalent. Typical size is 20 ft long with diameters to 8 ft in 6-in. increments. Each end of each section has flanges which are 3 in. by 3½ in. by ⅜ in., rolled angles are welded to the shell prior to firing. Each panel or section is glass coated with two coats of acid-resistant glass. Both the interior and exterior are coated. The units may also be used as fume vents.

Olson elected president of Compressed Gas Assn.

A. R. Olson, Suburban Propane Gas Co., Whippany, N.J., was elected president of the Compressed Gas Association, Inc., at the 45th annual meeting held recently in New York's Waldorf-Astoria Hotel. Other new officers include: Claude E. Monlux, Linde Co., New York, first vice president; and George C. Cusack, Pure Carbonic Co., New York, second vice president. Franklin R. Fetherston was re-elected secretary-treasurer.

Memphis firm acquires Huntington Industries

Tennessee Fabricating Co., Memphis, recently acquired control of another Memphis firm, Huntington Industries, Inc. All products—ornamental iron work, porch columns, railings, etc.—will be made as before, Tennessee Fabricating reports.

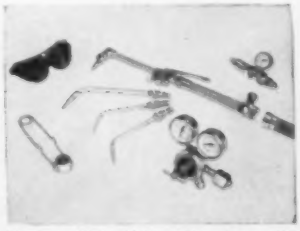
Never before at this LOW price!

Smith's new "Big 98" for $98

All purpose combination WELDING CUTTING outfit

DOES MULTIPLE JOBS . . . welds, burns, heats, brazes, solders and treats your pocketbook kindly—the best buy of the year! Welding range, with 3 tips supplied, is 1/32" to 3/8", but nine other tips increase welding capacity to 7/8". With the cutting assembly and tip furnished, you can burn steel from 1/8" to 1" in thickness (other tips increase cutting range to 4")—*clean, high speed cuts with minimum gas consumption.*

SLIP-IN TIPS make operation easier and faster. Tighten with finger pressure only—no wrench needed. Special-purpose tips (send for free Smith's catalog) adapt this torch to scarfing, rivet washing and gouging. All Smith's tips have recessed, damage-proof seats. Exclusive "Flo-Trol" diaphragm stops causes of backfires—eliminates seat burn-out by preventing reverse flow of acetylene: protects torch against premixing of gases—reduces downtime.



The new "Big 98" combination outfit gives you the standard torch handle, 3 welding tips, cutting assembly, 1 cutting tip, Oxygen Regulator, pre-set Acetylene Regulator, goggles, torch lighter, and hose—all for only $98.00 (U.S.A.).

SMITH'S

SMITH WELDING EQUIPMENT CORPORATION

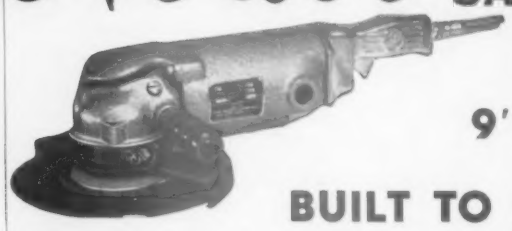
2623 FOURTH STREET S. E.
MINNEAPOLIS 14, MINNESOTA

One of America's pioneer manufacturers of equipment for welding, cutting, heating.

LOOK AT THESE OUTSTANDING FEATURES ON THE MODEL E-2

SINCE 1926

Nedco SANDBRUTE



A
2 H. P.
9" GRINDER
AND
BUILT TO USE IT ALL

2 H. P. Motor With Latest Type Balanced Basket Weave Armature
Extra Heavy Duty Spiral Bevel Gears; 5,300 or 6,000 R.P.M. Optional
Oversized Spindle and Armature Ball Bearings
Extra Heavy Duty Plastic Covered Cord With Ground Connector
Lightweight All Magnesium Housings (Guaranteed Not to Break)
Nedco Handy Grip Front End
20 Amp. Dust-Proof Safety Switch
Over Sized Cooling Fan
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Nedco Patented Cushion Disc Support

The Genuine NEDCO is Built only by

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Pioneer Builders of Portable Electric Grinders
WRITE FOR CIRCULAR ON COMPLETE LINE

It's NEW! Jiffy Boy
Welding Cable Reels

ONE OF THEIR MANY USES

Saves time and labor in welding cable handling—prolongs cable life—keeps cables reeled up and out of the way—reels for cables any length—carries up to 500 amps—

DISTRIBUTOR TERRITORIES AVAILABLE

Write or See Your Welding Supply Distributer or

HEFFNER PRODUCTS
2338 Brooklyn Rd., Jackson, Michigan

Norden-Ketay, Solar merge

The integration of Norden-Ketay Corp., Stamford, Conn., designer and builder of complex electronic systems and instruments, and Solar Aircraft Co., San Diego, was recently approved by directors of both firms. Combined employment of the companies is about 6,300.

Welded bridge girders for New England bridge

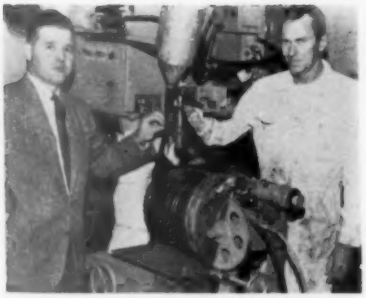
Four 295-ft, 138-ton steel girders are being welded by J-K Welding Co., Inc., of Yonkers, N.Y., for the Mianus River Bridge in Connecticut, a link of the New England Throughway. The gigantic beams, among the longest in the world, will be floated on barges down the Hudson river and up Long Island Sound to the Mianus River.

Sylvania electroplates copper on aluminum strip

A process for electroplating copper on aluminum strip and wire has been developed by Sylvania Electric Products, Inc., Warren, Pa. Permitting plating of aluminum strip in widths up to 10 in., and in thicknesses from .008-in. to .050-in., the new technique results in thickness of the copper plating ranging from a flash coating to .002-in. per side. Aluminum plated by this process can be thinned, soldered or formed without breaking the copper plating, says Richard E. Corcoran, product sales manager of wire and weld.

Weldor at work

ONE of the nation's oldest weldors, Herbert Quartz, here straightens a turbine spindle in Chemainus on Vancouver Island, British Columbia. He recently authored a book "The early history of welding in the United States." In July and September WELDING ENGINEER (1956) articles, Mr. Quartz recalled the early days of welding. He is now a consultant for Allis-Chalmers Mfg. Co., Milwaukee.



Welding instructor sets California wise

A welding instructor at California State Polytechnic College received the State Merit Award for a suggestion expected to save the state some $30,000 annually.

Enrico P. Bongio received $100 for recommending that the state buy its own cylinders for oxygen, acetylene, nitrogen and other gases to eliminate payment of demurrage on vendor-owned cylinders. At three cents a day per cylinder, the state spent a total of $30,000 on demurrage charges last year. Bongio's suggestion was successfully tried out by state agencies before the award was made.

Half of his award money Bongio gave to the Cal Poly student chapter of the American Welding Society, one of two such campus groups in the nation.

Missile chief at Ohio ACE Day

Major General John B. Medaris, commanding general of the U.S. Army Ordnance Corp.'s Ballistic Missile Agency at Huntsville, Ala., is to be keynote speaker at the Fifth Annual Conference for Engineers and Architects. The conference will be held Friday, May 2 on the Ohio State University campus at Columbus. Sponsored by the College of Engineering, the departments of chemical, mechanical and welding engineering and physics will give discussions in the field of nuclear engineering.

Chicago AtomFair draws weld industry

Some of the firms to exhibit at the 1958 AtomFair March 17 to 21 in Chicago's International Amphitheatre are: The Budd Co., High Voltage Engineering Corp., International Nickel Co., Inc., Linde Co., Mallory-Sharon Metals Corp., National Lead Co., Tracerlab, Inc., Union Carbide Corp., United States Steel Corp. and Westinghouse Electric Corp.

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The NEW DUROGON

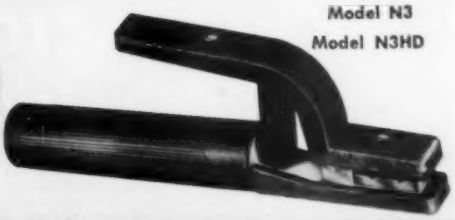
The Standard DURO Holder

Standard

Perfect Balance • Easy Replacement of Parts • The Long Jaw makes the hard to get at places easily accessible. After 26 years of proven performance these features make the DURO Standard still the Preferred Holder.

DURO'S NEW Holder The Durogon

Model N3
Model N3HD



Model N3 New alloy, high tensile strength, light-weight aluminum body.
Long Life Copper Alloy renewable jaws.
Extremely cool operation. Fully Insulated.
Jaw Insulation resists high temperature.
All parts quickly replaced using only a screwdriver.
Rugged Heavy-Wall Fibre Grip.
Solderless Type, proven cable connection.

Model N3HD Recommended for Heavy Duty continuous service.
All the features of the Aluminum model Durogon, but this body is made of rugged high conductivity bronze for super conductivity and choice of mechanical, soldered or brazed cable connection.
In addition, this heavy duty model has an extra long, heavy-wall fibre grip.

Write for literature and name of nearest distributor.

DURO ENGINEERING COMPANY
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THEY LOOK ALIKE...

BUT THERE'S A BIG DIFFERENCE INSIDE

. . . AND THERE'S A BIG DIFFERENCE INSIDE ACETELYNE CYLINDERS, TOO. ONLY COYNE BRINGS YOU THE MAGIC MONOLITHIC FILLER LIGHTER—MORE ABSORBENT—FASTER FILLING FOR QUALITY—TO THE CORE—PICK COYNE

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24 COMMERCE STREET, NEWARK, N. J.

Increase Service Life of Tractors!

Reclaim **WORN TRACTOR PARTS** *with* **MANGANAL**

11 ¾-13½% MANGANESE-NICKEL STEEL

APPLICATOR BARS & WELDING ELECTRODES

- Work hardens to 550 Brinell
- Tensile strength up to 150,000 psi
- Outlast new parts

SPROCKETS

BLADES

RAILS

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NATIONAL WELDING SUPPLY ASSOCIATION MEMBER

SOLE PRODUCERS

Write for How-to-do-it Bulletin and name of nearest distributor

STULZ-SICKLES CO.

PORT AVENUE at JULIA ST. ELIZABETH, NEW JERSEY

Engelhard merger

ATTENDING an industrial exhibition at New York's Waldorf-Astoria following the announcement of the merger of nine domestic firms into Engelhard Industries, Inc., are *(left to right)* Robert Jones of American Platinum and Silver Div. of Engelhard; Robert Fuller of Induction Heating Corp., Richard Rinaldi and Stanley Cross of American Platinum, and Herman C. Phelps, Eastern district manager of WELDING ENGINEER. They are viewing a process of silver brazing automotive refrigeration hose using "Silvaloy" preformed rings.

Inco sponsors welding forum

Engineers working on atomic energy projects attended a welding forum held at International Nickel Co., Inc.'s Bayonne, N.J. works Jan. 20 to 24. Welding techniques applicable to nickel and nickel-containing alloys were demonstrated and discussed during the five-day program. About 20 representatives from atomic energy plants attended the forum, one of 48 held since 1950 for industry and special groups.

LP gas sales up 4.1% in '57

During 1957, LP gas sales increased 272 million gallons, 4.1% over the 1956 total, pushing total sales to about 6,907,700,000 gal. This exceeds estimated increases in sales of all other petroleum products.

Norelco to exhibit at two shows

X-ray diffraction, radiography and contact microradiography equipment will be featured at two shows by Philips Electronics, Inc.'s instruments division, Mount Vernon, N.Y. From March 3-7, Norelco displays will be at the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, and in Boston on June 23-27, at the ASTM Exhibition, Hotel Statler.

COMING EVENTS

MARCH 3: All-Day Machine Conference of the Cleveland Engineering Society, Cleveland.

MARCH 17-21: 1958 Nuclear Congress, International Amphitheatre, Chicago.

MARCH 17-21: 1958 International Atomic Exposition trade show in conjunction with 1958 Nuclear Congress, International Amphitheatre, Chicago.

MARCH 19-21: Fifty-eight Annual Convention, International Acetylene Association, Bellevue Stratford Hotel, Philadelphia.

MARCH 27-28: First Annual Western Welding, Brazing and Heat-Treating Conference, Menlo Park, Calif.

MARCH 27-29: Santa Clara Valley AWS Welding Show, Santa Clara County Exposition Hall, County Fair Grounds, San Jose, Calif.

APRIL 14-18: Sixth Spring and Thirty-ninth Annual Meeting, American Welding Society with American Society of Mechanical Engineers Conference, Hotel Statler, St. Louis.

APRIL 15-17: Sixth Annual Welding Show, American Welding Society, Kiel Auditorium, St. Louis.

MAY 2: Fifth Annual Conference for Engineers and Architects, Ohio Union, Ohio State University, Columbus.

MAY 5-8: Fourteenth Annual Convention, National Welding Supply Association, Americana Hotel, Miami Beach, Fla.

MAY 12-16: Southwestern Metal Exposition, State Fair Park, Dallas.

MAY 15-16: Third Annual Welding Exposition, Utah State University, Logan, Utah.

Sunny outlook for chilly process

With American industry expanding its use of extremely low temperatures, the future of Air Products, Inc., looks bright, that firm states in its annual report. Only two years ago Air Products sales were at the $10-million level; this year sales volume is just under $35 million and shows signs of continuing, the firm predicts.

The low-temperature processes are used in the iron and steel industries, in providing liquid fuels for rockets and guided missiles, and in the chemical industry.

Distributor appointments

Galland-Henning Nopak Div., Milwaukee: Air Flow Co., Philadelphia.

Harnischfeger Corp., Milwaukee: Ardagh Welding Supply Co., Chicago.

Tec Torch Co., Carlstadt, N.J.: Southern Oxygen Co., Washington, D.C.; Delta Oxygen Co., Inc., Memphis; Zane Weld Craft Supplies, Inc., Hartford, Conn.; Central Machinery & Supply Co., Biscayne Annex, Miami.

as **new** as tomorrow . . .

- easy
- efficient
- economical

ONLY Torch made with standard size TRANSPARENT NOZZLE assuring absolute visibility.

The Tec Visuweld Torch

FOR FASTER, BETTER TUNGSTEN INERT GAS WELDING

- Lightest weight, most superbly designed torch in industry.
- Guaranteed gas and water leak proof because of one-unit torch head, no fittings or gaskets.
- Three torches in One . . . perfect welds from 3 to 350 Amps.

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NATIONAL CARBIDE
IN THE RED DRUM

HIGHEST QUALITY

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DEPENDABLE SUPPLY

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

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AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT

WELDING GALVANIZED?

Then galvanize your welds with

Galvalloy

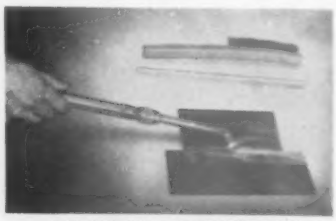
GALVALLOY is BEST because

- it bonds quickly
- it bonds permanently
- it bonds to most metals
- it withstands 30 day salt test

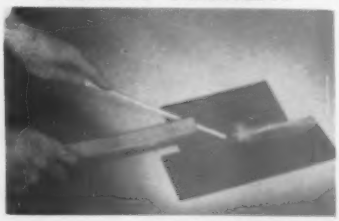
GALVALLOY is EASIEST TO USE because

- it melts at a higher temperature
- less than 1/5 as much required
- it covers 60-70 ft.of weld per lb.
- it will not burn from excess heat

EASY TO APPLY



MERELY PREHEAT



THEN RUB ON

AVAILABLE AT YOUR WELDING SUPPLY DISTRIBUTOR OR WRITE

METALLOY PRODUCTS CO.
1233 S. BOYLE AVE., LOS ANGELES 23

Sidney Wade has been appointed manager of distributor products for Linde Co., New York City. He will continue as manager of the Gas Apparatus Div., while being responsible for marketing activities of all Linde products for sale through welding supply and other channels.

E. A. Quinlan, salesman for the Minneapolis District of Air Reduction Sales Co., has been appointed assistant sales manager of that district. With Airco more than 20 years, Quinlan has served in Minneapolis and Chicago.

L. S. Hilton has been appointed sales manager of the Abrasive and Diamond Wheel Depts. of Raybestos-Manhattan, Inc., Passaic, N.J. He succeeds *W. H. Steinberg*, now technical consultant.

By action of Wall Colmonoy Corp.'s board of directors, *W. P. Clark* has been named president of the firm. *A. F. Wall*, founder of the firm and former president, recently assumed duties as chairman of the board.

Clark

Three members of Westinghouse's welding department were recently promoted. They are: *Gordon Cossaboom*, supervisor of product planning, *W. Earle Harwood*, manager of welding field sales and *Floyd Adamson*, engineering supervisor for automatic equipment.

Richard L. Deily has been named sales manager for a new line of American Messer Corp. cutting machines. He will set up a sales and service organization throughout the U.S. for the New York firm's oxygen cutting machines used in fabricating, shipbuilding and steel industries.

Recently added to the sales staff of Valley Supply Co., Ottumwa, Ia., as territory salesman, was *Ray Yeager*.

TILLMAN
Gloves—Garments

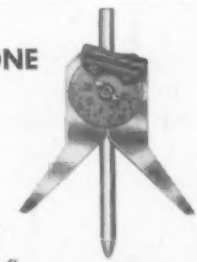
WELDORS BUY FROM YOUR DEALER

ASK FOR OUR NEW CATALOG

BRAZILIAN DEERSKIN
THE "STAY SOFT" LEATHER
GLOVES AND MITTENS

TILLMAN PRODUCTS
John Tillman & Co.
Long Beach, Calif.

Really FIVE TOOLS in ONE



Yes, actually a BOYCE Centering Head replaces

- ✓ The Protractor
- ✓ The Centerhead
- ✓ The Center Punch
- ✓ The Level
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Determines Center Line at any Degree and Measures Degree of Declivity

Weighs only 9 ozs. Pocket size.

DIAL SET LEVEL

Y type head accurately machined with tangents and tips for centering and aligning. Dial Set Level in graduations of 2½ and 10 degree markings. Punch of Drill Rod with hardened point—insuring long service. Send for complete description.

CONTOUR MARKER CORP.
1843 E. Compton Bl., Compton, Cal.
Also Mfgs. of Contour Markers, Radius Markers and Pipe Flange Aligners.

BOYCE CENTERING HEAD

Elected to the board of directors of Pressed Steel Tank Co., Milwaukee, was *H. E. Brumder*, vice president in charge of engineering and manufacturing. He also is president of the Downingtown Iron Works, Inc., Downingtown, Pa., a division of the firm.

Richard B. Kropf has been appointed supervisor of development activities in the automotive industry for International Nickel Co., at the Detroit Technical Field Section office. He succeeds *E. J. Hergenroether*, who has retired. Recently promoted was *Robert E. Savage*, now in charge of the distributor sales section of the nickel department.

Crucible Steel Co., Pittsburgh, recently appointed *Kenneth A. Matticks* to the new position of manager of products development, Stainless Steel Sales Div.

H. W. Cook, Jr. has been appointed district sales manager, Page Steel & Wire Div., American Chain & Cable Co., Inc. He has been transferred from the New York sales district to Houston, Texas.

New president of Vickers, Inc., Detroit, is *J. Frank Forster*. He also has been elected to the board of directors of the firm.

In the New Orleans district of Air Reduction Sales Co., *S. A. Bruno* will replace *L. F. Bruno*, who has retired as district manager after 38 years of service. S. A. Bruno had been assistant sales manager, a post which will be filled by *F. T. Wilson, Jr.*, who was a salesman in the Louisville, Ky., district.

Receiving awards on Dockson Corp.'s 35th birthday were: President *Harold E. Piggott*, with the Detroit firm 35 years, and 25-year men *Charles W. Piggott*, vice president and *Joseph Kramer*, development engineer. Left to right above, C. Piggott, H. Piggott and J. Kramer.

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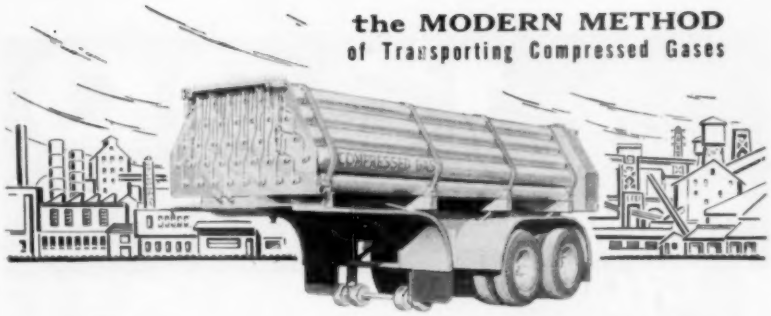
of Transporting Compressed Gases



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- MANIFOLD & CONTROLS — for YOUR Gas and Handling Requirements
- CAPACITY — to meet YOUR Requirements
- SAFETY — Cylinders, Safety Devices, Controls etc., All in accordance with ICC Requirements for YOUR Protection.
- CHASSIS — by leading Chassis Manufacturers with Service Branches throughout the United States for YOUR Convenience.

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CYLINDERS AND GAS PRODUCING EQUIPMENT
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FOR WORLD'S FINEST WELDS IN ALUMINUM GET CLEAN, CLEAN, CLEAN PRECISION SPOOLED WIRE
from
WORLD'S ONE AND ONLY COMPLETE LINE of joining and sealing Alloys and Fluxes for ALUMINUM

Alloys and Fluxes for joining ALL METALS by ALL METHODS
TORCH WELDING
SOLDERING · FILLING · SEALING
TORCH BRAZING
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ALLOYS
All-State
FLUXES
ALL-STATE ALLOYS AND FLUXES FOR USE ON ALUMINUM AND ALUMINUM WITH DISSIMILAR METALS ALL METHODS

Includes six (6) solders for aluminum and aluminum to dissimilar metals

PRECISION SPOOLED

Any All-State aluminum alloy that you select can be furnished as 3/64, 1/16, 3/32 and 1/8" diameter bare wire, **precision** spooled for inert gas machine application and other purposes.

All wire spooled by All-State is extruded, sized and tempered . . . is clean . . . is free from enfolded drawing lubricants.

Sold only in plastic bags, factory-sealed after the twin operation of a special chemical-mechanical pre-clean and precision spooling.

See Live Demonstration—Booth 604, AWS Show

ALL-STATE WELDING ALLOYS CO., INC., WHITE PLAINS, N. Y.

NEW 1200 Silver Brazing Flux

For use when silver brazing Brass, Bronze, Copper, Nickel-Silver, Steel, Stainless Steel, Monel, Nickel and Inconel.

- NEW wide-mouth 5 lb. container assures easy removal and prevents waste.
- A soft creamy-flux that applies easily over work surface with a minimum of effort by the operator.

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Linde Co. recently appointed *Robert H. Bennewitz* assistant manager of the Railroad Dept. He will headquarter in Chicago. Bennewitz joined the firm in 1941 and has served in Milwaukee, Detroit and Kansas City, Mo.

Joe DeSanto has been appointed manager of welding sales, Chicago district of Champion Rivet Co., headquartering at the E. Chicago, Ind., plant.

James I. Julian has been appointed vice president of the newly-formed Solar-Chicago Co., a division of U. S. Industries, Inc. He will take charge of production, engineering and service for the firm's two subsidiaries—Solar Permanent Co. and Chicago Steel Tank Co.

Arnold C. Jensen (right) has been named field representative in the Los Angeles area for Alloy Rods Co., York, Pa. He succeeds John M. Pierce.

George A. Chandler has been chosen manager and *Melvin L. Henry* has been appointed production manager at the New Haven, Conn. plant of Western Brass Mills division of Olin Mathieson Chemical Corp. *Kenneth Soper* takes over as superintendent of mill products at the E. Alton, Ill., division plant.

G. K. Willecke has been appointed director of the research department recently established by Miller Electric Mfg. Co., Appleton, Wis. He will guide efforts of the laboratory to be centered on problems involving the arc-welding process.

Willecke

McGuinn

Clifford D. McGuinn has been appointed vice president in charge of field operations at the NCG Div. of National Cylinder Gas Co., Chicago. *Glenn Moore* is controller of the new division. McGuinn will be in charge of regional and district sales and distribution of industrial gases, welding and cutting equipment.

New sales manager of Pure Carbonic Co.'s northeastern region is *N. L. Heffron*, formerly manager of the Newark district. Heffron will be responsible for all direct selling activities in the nine states from New Jersey to Maine.

Westinghouse Electric Corp. recently announced new appointments which went into effect Jan. 1: *Gwilym A. Price*, chairman of the board; *Mark W. Cresap, Jr.*, president and chief administrative and operating officer; *E. V. Huggins*, chairman of the executive committee of the board of directors and vice president; *John K. Hodnette*, executive vice president; *George G. Main*, vice president-finance; *Francis E. Dalton*, controller; *Carlisle P. Myers*, corporate secretary; *Russell B. Read*; assistant treasurer.

E. M. Branch has been appointed engineering representative, the Stainless Processing Div. of Wall Colmonoy Corp., Detroit. Branch is assigned to the Montebello, Calif., plant where he will provide application engineering assistance to users of high-temperature brazed assemblies.

Dr. Donald J. McPherson has been named manager of the metals research department at Armour Research Foundation of Illinois Institute of Technology, Chicago.

Died . . .

John H. Merrell, honorary director of Raybestos-Manhattan, Inc., died Jan. 4 at Chicago. He joined the firm in 1903 and rose from Chicago branch manager to vice president and director.

Frank X. Gilg, 57, an executive assistant in the Boiler Div. of Babcock & Wilcox Co., died suddenly January 26 at his home in Bronxville, N.Y., after a heart attack. Less than eight hours after his death, Mr. Gilg's widow, *Mrs. Helen Tatnell Gilg*, also suffered a fatal heart attack. He was a member of the International Institute of Welding.

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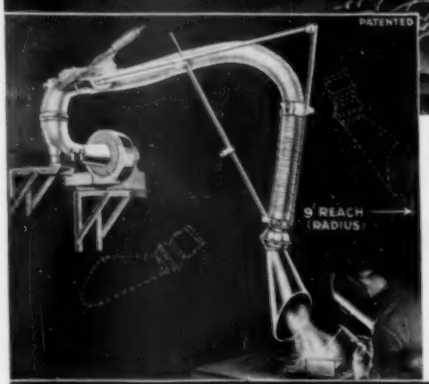

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51. HAND TRUCKS—Welded Truck & Specialty Co. Illustrated booklet details line of standard and custom hand trucks. Includes specifications.

52. FURNACE EQUIPMENT—Rolock Inc. Page gives examples of furnace and heat processing equipment engineered and welded by firm. Includes muffles, furnace baskets, retorts and trays.

53. FIRE SAFETY — National Safety Council. New publication, "This'll burn you up," points out things to remember in case of fire.

54. ALLOYS FOR STEEL — All-State Welding Alloys Co., Inc. Pamphlet covers 14 alloys and fluxes for application to steel. Includes charafer rod, paste solder and cold-applicable metal filler.

55. RADIOGRAPHIC MATERIALS—Eastman Kodak Co. "Materials and accessories for industrial radiography," is title of booklet containing guide chart for selection of film for various material thicknesses.

56. ARC WELDER—Birdsell Mfg. Co., Inc. Page pictures and details heavy industrial welder model 300B, includes specifications and applications.

57. HEATING EQUIPMENT—Allis-Chalmers Mfg. Co. Bulletin 12B8513 covers high frequency motor-generator induction heating equipment for brazing, annealing, deep hardening, forging and melting.

58. BERYLLIUM—Brush Beryllium Co. Reprint No. 19 is titled, "Could beryllium be used as a structural material?"

59. RESISTANCE WELDING — Sciaky Bros., Inc. Reprint of article, "800 per hour cycling rate," covers fully-automatic machine. Vol. 19, No. 4.

60. BRAKES—Warner Electric Brake & Clutch Co. New catalog WEB 6292 gives facts on electric brakes, clutches and controls for miniature mechanisms or high torque machine drives, including welding positioners.

61. SPUR GEAR—Wall Colmonoy Corp. "Spur gear life increased over 3,400 percent by hardfacing," is title of article in Vol. 2, No. 5.

62. LOW HYDROGEN ELECTRODES—Harnischfeger Corp. Bulletin R-48 explains high tensile and heat-treatable low hydrogen electrodes.

63. WELDERS—National Electric Welding Machines Co. Vol. 2, No. 1 of Welding News pictures and explains line of welding machines.

64. EXTINGUISHERS — C-O-TWO Fire Equipment Co. Booklet explains portable fire extinguishers, hose units, smoke detecting systems, recharging equipment.

65. ACCESSORIES—Fibre-Metal Products Co. Suggested price list of welding accessories and industrial safety equipment.

66. HARDFACING—Coast Metals, Inc. Engineering data on hardfacing alloys 18 and 118.

67. STAINLESS STEELS—Eutectic Welding Alloys Corp. New 12-page booklet "Fabricating the stainless steels," discusses metallurgy of different steels, offers data to prevent weld weakening intergranular corrosion.

68. ELECTRIC SETS—Caterpillar Tractor Co. Booklet covers portable electric sets to provide power. Includes self-regulated generators.

69. HEAD, TAIL STOCKS—Cayuga Machine and Fabricating Co., Inc. Bulletin 5703 covers head and tail stocks for turning large structures and frames when positioner is not applicable.

70. ABRASIVE PRODUCTS—Carborundum Co. NWSA index 1010 details abrasive products for welding. Includes specifications of center wheels, discs, back-up pads, cut-off wheels, etc.

71. GOGGLES—Welsh Mfg. Co. NWSA index 930 pictures soft side cover goggles with pliable contour fitting frame.

72. CONTROL VALVE—Indiana Oxygen Co. Bulletin describes "Flame master" electric control valves and push button torch lighter.

73. SPECIFICATIONS—Peter A. Frasse & Co., Inc. Chart identifies stainless steel specifications. Shows chemical analysis requirements for most frequently used military specifications.

74. FILM BADGE SERVICE—St. John X-Ray Laboratory. Film badge service to guard against radiation hazards is explained in folder.

75. BRONZE WELDING—Bridgeport Brass Co. Leaflet details bronze welding alloys for repairing iron, steel, brass, bronze and copper parts.

76. COPPER FOIL—American Brass Co. 8-page illustrated booklet suggests commercial applications of paper-thin copper foil. Publication D-8-R describes properties, architectural uses, etc.

77. H-F INDUCTION — Lindberg Engineering Co. 12-page catalog describes line of high frequency induction units and accessories for rapid high temperature combustion of laboratory samples.

78. TUNGSTEN—Kennametal, Inc. "Kenplate tungsten carbide surfacing," is title of a new bulletin covering a product used to protect metal parts against abrasion and wear.

79. WELD INSERT—Arcos Corp. Booklet explains weld insert process, which permits deposition of root pass even though actual welding done on one side only. Especially suitable for butt welding of pipe.

80. BRIDGES—Dominion Bridge Co., Ltd. "Bridge briefs" is title of booklet 39 picturing new innovations in bridges, including Canada's first permanent floating bridge.

81. HARDFACING — Rankin Mfg. Co. Hardfacing welding in "preventative maintenance" explained in 2-color, 4-page brochure. Guide helps choose proper hardfacing rod.

82. TORCHES—Tec Torch Co., Inc. Water cooled torches for Tig welding pictured and explained in leaflet.

83. SOLAR CELLS—International Rectifier Corp. RN-1057 tells of new silicon solar cells to convert radiant or solar energy into electrical power.

84. ALUMINUM — Kaiser Aluminum & Chemical Corp. "Metal, men and imagination," is title of photo file No. 2, a compilation of photos showing metal in making.

85. DISCS — Grinding Wheel Institute. Standard on machine mounting specifications for abrasive discs and plate mounted wheels, B5.35, issued by American Standards Assn.

86. LINK SHAFT—Clark Flexible Link Shaft Co. New flexible shaft with equal torque, unlimited length and equal flexibility in all sizes from 3/8 in. to 3 in. diameters described in booklet.

87. PLASTIC MOLDING COMPOUND—Duramic Products Div. Bulletin 113, a 2-page data sheet, describes plastic molding compound to make molds for casting cold setting ceramics and plastics.

88. BENDERS—Wallace Supplies Mfg. Co. Booklet cleverly presents firm's benders, including rotary, ram and roll.

89. HYDRAULIC FLUIDS—Vickers, Inc. Bulletin 1300SA, "Selection, operation and maintenance of hydraulic fluids for industrial machinery," is aimed at maintenance men who deal with hydraulics. Describes characteristics of petroleum base and fire-resistant hydraulic fluids.

90. HANDLING DEVICES—Merrill Brothers. Catalog C-1 contains 16 pages of product illustrations, application drawings, tables, diagrams, engineering data on materials handling devices.

91. CUTTING TOOLS—Carborundum Co. Case history 103 on oxide cutting tools lists comparison data.

92. ALUMINUM—Aluminum Co. of America. Hard-bound Alcoa Aluminum Handbook is 176-page reference of tables and technical data on properties of Alcoa alloys and aluminum.

93. MOVIES—U. S. Steel Corp. List of motion pictures available to groups gives run-down on each movie.

94. FIRE EXTINGUISHER—General Detroit Co. Dry chemical fire guard is diagrammed and explained in bulletin. Includes specifications.

95. OXYACETYLENE PRODUCTS—Linde Co. 6-page booklet tells role of oxyacetylene flame in speeding ship repair and fabrication work. Includes such processes as flame-planing, rivet-busting, mechanized shape cutting, etc.

96. CUTTING TOOL—Indiana Oxygen Co. Bulletin on model 1000 "Cut-a-line" offers specifications, explanations and shows tool in operation.

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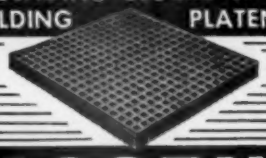

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125. Adjustable Clamp Co.—Catalog available on complete line of "Jorgensen" and "Pony" clamps.

126. Alloy Rods Co.—Bulletin AR-10 will help you on your stainless steel welding problems.

127. Alloy Rods Co.—Bulletin HS-102 gives complete details on the "Wear-O-Matic" wire feed unit.

128. All State Welding Alloys Co., Inc. —Write for further information on precision spooled wire by All-State.

129. American Brass Co.—For general information on the properties of copper conductors, plus convenient new tables giving physical and electrical data, send for the 62-page publication C-25 and B-13.

130. American Manganese Steel Div.—Write for technical data on hardfacing with "Amsco 20".

131. American Platinum & Silver Div. —Two reference manuals "A Complete Guide To Selective Fluxing For Low Temperature Silver Brazing" and "A Complete Guide to Successful Silver Brazing", are available.

132. Ampco Metal, Inc.—Bulletin W-17 will give you further information on "Phos-Trode" and other Ampco electrodes.

133. Aro Spot Welders Div.—Illustrated literature on the new Aro "Model 410" portable spot welder.

134. Atlantic Abrasive Corp.—Catalog available on Atlantic Grinding Wheels, to help you in any type of metal removal or smoothing problems.

135. Atlas Welding Accessories Inc.—Further information available on the new wood grip weld cleaning tools.

136. Bay State Abrasive Products Co.—Information available on the new grinding technique for grinding hard to reach surfaces without fatigue.

137. Belden Mfg. Co.—Write for further information on Belden's welding cable.

138. Bernard Welding Equipment Co.—Further information available on the "Shortstub" electrode holder.

139. Burdett Oxygen Co.—Write for further information on Burdox liquid oxygen and industrial gases.

140. Carol Cable Co.—Information on "Dynapower" welding cable available.

141. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

142. Contour Marker Corp.—Details on establishing and marking a point at any angle.

143. Coyne Cylinder Co.—Write for details on Coyne Acetylene Cylinders.

144. Duro Engineering Co.—Write for further information on Duro's standard holder and the new holder "The Durogon", also for name of nearest distributor.

145. Electrons, Inc.—More information on ignitron tube ELC-3J for low maintenance cost, is available.

146. Eutectic Welding Alloys Corp.—Write for further information on Eutectic "Low Temperature Welding Alloys".

147. Fibre-Metal Products Co.—Send for bulletin No. 41 on the "Monarch" F-300 face shield.

148. Flood Safety Products Co.—Data on heat and moisture-resistant "No. 14" fiber glass and "No. P-14" all plastic ratchet-type helmets.

149. General Electric Co.—Information on cost-cutting non-synchronous controls for resistance welding and bulletins GEA-6408 (standardline) and GEA-6593 (customline) are available.

150. Goldsmith Bros.—For complete information on low temperature silver brazing write for a copy of the GB data book.

151. H & M Pipe Beveling Machine Co.—Full details are available on the H & M Shape Cutter.

152. Harnischfeger Corp.—Write for bulletin R-29 on P & H iron-powder electrodes.

153. Harnischfeger Corp.—Bulletin R-29 available on low-hydrogen iron-powder electrodes.

154. Harnischfeger Corp.—For further information on low-hydrogen electrodes, write for Bulletin R-29.

155. Harrisburg Steel Co.—Further information available on the Harrisburg high pressure gas cylinders.

156. Harris Calorific Co.—For more details on the new No. 43 welding and cutting torch write for the welding torch chart.

157. Heffner Products—Write for further information on welding cable reels and for information on distributor territories.

158. Hobart Brothers Co.—Further information and prices available on the complete line of Hobart's arc welding equipment.

159. Hobart Brothers Co.—Write, if you are interested in trying the new "Rocket 10-ip" iron powder electrodes.

160. Hoeganaes Sponge Iron Corp.—Folder No. 106 explains what you can expect from Hoeganaes iron-powder-coated electrodes.

161. Independent Engineering Co.—Write for further information on transporting compressed gases by gas supply trailers.

162. International Nickel Co.—"A Handy Guide to Welding Cast Irons" gives useful technical data, case histories and tips on welding methods.

163. Jackson Products—Data available on Jackson's insulated copper alloy holders, ground clamps, cable connectors and splicers.

164. Lenco, Inc.—Details on heat-resistant, completely insulated "Hi-Amp" electrode holders.

165. Lepel High Frequency Laboratories, Inc.—Catalog containing information on high-frequency induction heating units for brazing, annealing, hardening, soldering, and melting.

166. Lewis Welding & Engineering Corp. —Bulletin 7703 describing Lewis automatic welding head manipulators is available.

(Continued on page 98)

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USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

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Welding Info-Aids,
Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Literature offered in ads

(Continued from page 96)

167. Lincoln Electric Co.—Bulletin SB-1337 has specifications and details to help you select machines and electrodes to do your welding job.

168. Linde Company—Write for further information on Linde's guaranteed inert argon welding gas.

169. Liquid Carbonic—Complete technical data available on new CO_2 shielded gas welding.

170. Lummis Mfg. Co.—Write for further information on "Key-Bak" and name of nearest jobber.

171. Magnaflux Corp.—Details available on how you can have welds inspected by Magnaflux commercial inspectors.

172. Mahattan Rubber Div.—Information available on "Manhattan Moldiscs" portable grinding wheels.

173. Merrill Brothers—Information on lifting clamps, twin and drum lifters, drum tilters and other material-handling devices.

174. Metal & Thermit Corp.—Write for your copy of "Electrode Selector," an easy reference for selection of correct electrode for any application.

175. Miller Electric Mfg. Co. Inc.—Complete particulars on the new Miller "Gold Star SRH" will be sent on request.

176. National Carbide Co.—Information on calcium carbide available, also name and address of nearest supplier.

177. National Welding Equipment Co.—Booklet available "you don't need an egg beater to mix gases."

178. Nedco Co.—Write for circular on complete line of Nedco's portable electric grinders.

179. Oxo Equipment Co.—Write for further information on Oxo safety regulators.

180. Page Steel & Wire Div.—Folder DH-402A, "Submerged Arc and Inert Gas Welding Wire," booklet DH-1277, "Gas Welding Rods," and a weld rod comparison chart are available.

181. Picker X-Ray Corp.—Write for information and advice concerning any phase of radiation-utilization.

182. Pressed Steel Tank Co.—Write for detailed facts and prices on Hackney high pressure gas cylinders.

183. Rankin Mfg. Co.—Write for your "Ranite" Select-O-Graph Guide, for picking the right rod for any job without guesswork.

184. Ruemelin Mfg. Co.—Write for bulletin 37-C explaining how to keep plant air clear of welding fumes.

185. Servospeed—Data on feedback circuits for constant torque over wide speed ranges.

186. A. O. Smith Corp.—Write for further information on the complete line of A. O. Smith a-c, d-c welding machines.

187. Smith Welding Equipment Corp.—Write for details on the new Smith "Big 98" all purpose combination welding cutting outfit.

188. Sonobond Corp.—Further information available on ultrasonic welding without fusion.

189. Square D Co.—Information on how magnetic or electronic welder control can best fit your applications.

190. Steel Sales Corp.—Write for further information on the new "1200" Silver Brazing flux.

191. Stulz-Sickles Co.—Write for How-to-do-it bulletin and name of nearest distributor.

192. Sylvania Electric Products Inc.—Details on complete line of color-coded electrodes for Tig welding.

193. Tec Torch Co., Inc.—Further information available on the "Tec Visuweld Torch" for faster tungsten inert gas welding.

194. Tempil Corp.—Information on, and sample pellets of, temperature indicators; state temperature desired.

195. Tennessee Fabricating Co—Catalog available on 400 casting designs.

196. Tillman & Co., John—Catalog available on weldor's gloves and garments.

197. United Specialties, Inc.—Complete information on "Weldreel" welding hose and cable reels available.

198. Victor Equipment Co.—Write for Cutting Tips Bulletin 314, describing the complete line of Victor cutting tips and which torch each fits.

199. Westinghouse Electric Corp.—Write for further information on the new "West-Ing-Gun" with its own self-contained wire supply.

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P.O. Box 28
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NOT GOOD AFTER JUNE 1, 1958

WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill.

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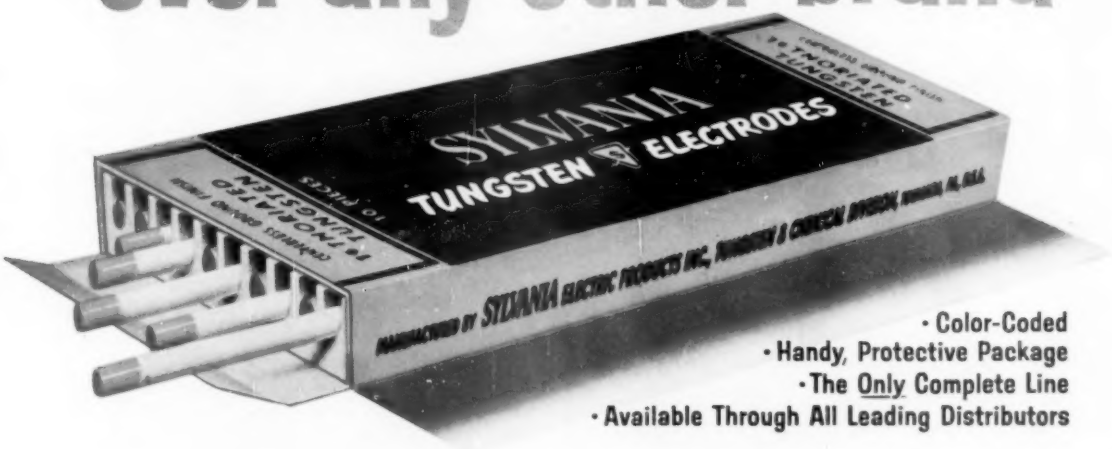
Here's why welders prefer Sylvania Electrodes over any other brand



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- The Only Complete Line
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EASIEST TO USE—easiest to get—widest range of applications—these are the important reasons why more welders use Sylvania Tungsten Electrodes than any other brand.

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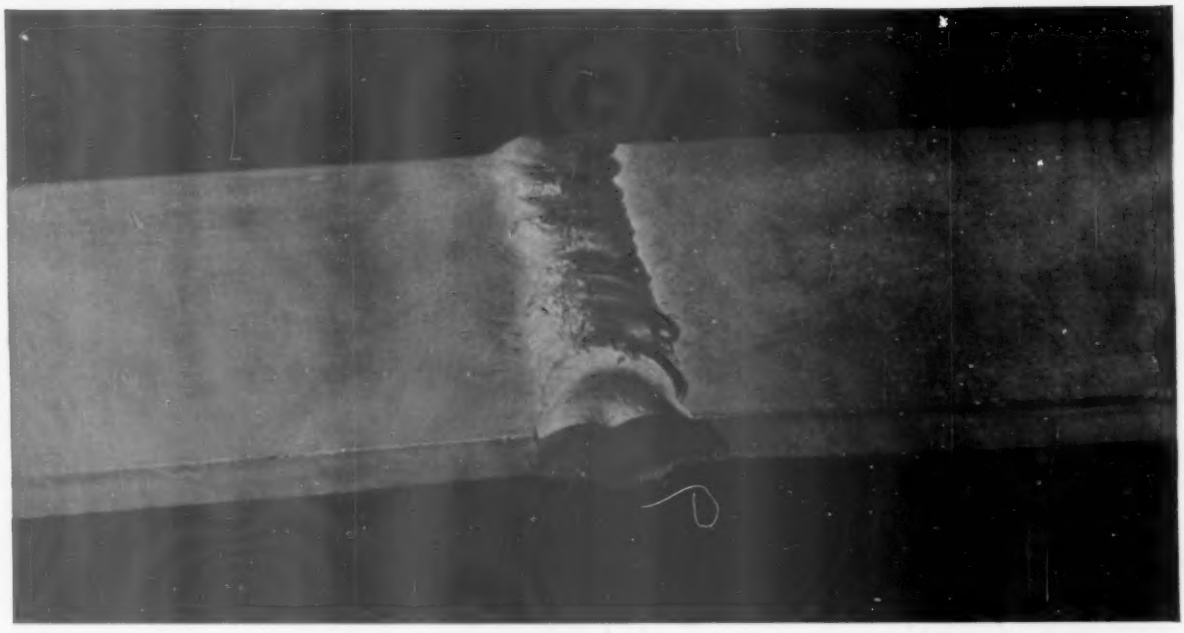

How to weld copper bus bars by the inert-gas arc process

Although bolted connections are the general rule in bus bar installations, there are many instances where permanent connections are desirable and economical in fabrication of components.

Welded joints can be used to effect savings in joint materials and bus bar (no overlapping is necessary as in brazed joints), at the same time adding but little to dimensions of conductors at the joint.

High-conductivity weld metal does not give the best joint. Any electrical advantage it might have is offset by the reduction of effective cross section due to weld-metal porosity.

But excellent results have been obtained in large copper bus installations where welds have been made with Anaconda Copper-372 Welding Rod and the inert-gas arc processes. Joints made in this way are sound and free from porosity. The volume of weld metal in the joint is a very small percentage of the conductor and has very little effect on the over-all resistance.

RESISTANCE MEASUREMENTS on ½"-wide sections cut from a ¼"-thick conductor welded with Anaconda Copper-372 Welding Rod by the inert-gas tungsten-arc process illustrate the point:

Test Length	Across the weld	Unwelded bar
1 meter	0.0002145 ohms	0.0002136 ohms
2 inches	0.00001319 ohms	0.00001085 ohms

It is obvious that when measured over lengths of several feet the increase in resistance caused by the weld is negligible. Furthermore, the high heat-conductivity of the adjacent base metal eliminates any tendency to produce hot spots.

WELDING METHODS. The inert-gas arc processes are preferred for welding copper conductors. Helium develops higher heat levels than argon and improves the flowing properties of the weld metal. It is the preferred shielding gas for tungsten-arc welding. Argon is the usual shield in the consumable-electrode process. When thicknesses exceed ⅛", the joint ends should be bevelled, and single-vee grooves with 90-degree included angle are the rule.

FOR MORE INFORMATION and details of procedures for various thicknesses, write for Anaconda Publication B-13. For general information on the properties of copper conductors—plus convenient new tables giving physical and electrical data on all types of Anaconda rigid bus conductors—send for 62-page Publication C-25. Address: The American Brass Company, Waterbury 20, Conn.

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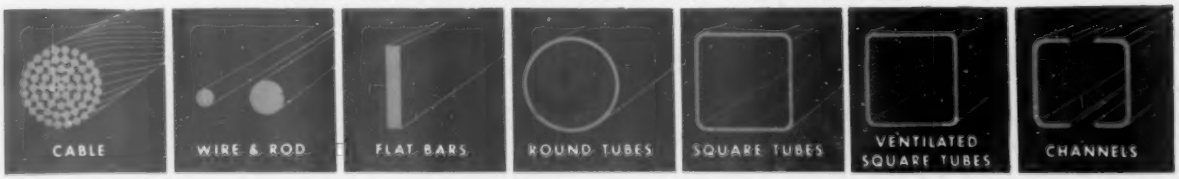
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